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ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

Melvin's Compound High-Speed Steam Engine.

The transmission of power by means of steam conveyed through properly lagged pipes has not been adopted as rapidly as it would have been were it not for the well-known wastefulness of ordinary small high-speed engines. The disadvantages of cut-off appliances upon such engines have rendered it somewhat difficult to produce an economical motor of moderate size and cost without necessitating the use of complicated mechanism, which is altogether out of place upon small engines running at high speeds.

In many of our large manufactories, gearings, or long lines of shafting and belts have been used in the transmission of power, when it would have been much more economical, and the first cost of changing or extending power would have been much less, if a motor possessing the requisite merits had been adopted at the outset.

We present herewith engravings of a new compound high-speed steam engine which is somewhat of a departure from previous practice in the way of small steam engines. This engine was designed by David N. Melvin, and is now being introduced to the steam-using public by James Beggs & Co., 9 Dey street, New York.

An inspection of the engravings will convince the reader that the engine represented has been reduced substantially to its simplest elements—namely, a cylinder, piston, connecting rod and crank. The perspective view shows the engine complete and ready for attaching the steam pipe. The internal and detailed construction will be made plain by aid of the sectional engravings. Some idea of its practical economy can be obtained from an examination of the indicator diagrams on page 2, which were taken from one of these engines while at work.

The frame *A* and smaller cylinder are cast in one piece and are fitted up in the simplest feasible manner, while the larger cylinder *B*, and the steam chest *C*, are contained in the same single casting (page 2).

The cylinder head is bolted to the bottom, as shown. In the larger sizes up to 50 H. P., the larger cylinder and steam chest are made in one casting, and are bolted to the flange of the frame, as shown in the perspective view. The large cylinder is surrounded by a steam jacket *T*, through which the steam passes from the boiler, thence through the openings, *V V*, into the steam chest *C*.

This jacket is better shown in Fig. 2, where the steam enters the jacket at *D*, passing around the annular space, *E*, *E*, finally entering the steam chest through the contracted space, *A*. The casting, *F*, *F*, is protected by a suitable lagging.

The steam finally escapes through the exhaust port *B*. The piston *E*, is of the trunk type and has two diameters. Steam is admitted into the annular space above at as near boiler pressure as possible, which drives the piston down. After completing this stroke the steam passes back through the ports, *S*, into the cavity of the valve, thence through the lower port *S* into the large space *B* under the piston, and forces it up. When the upward stroke has been completed, the steam is exhausted into the atmosphere through the port, *W*.

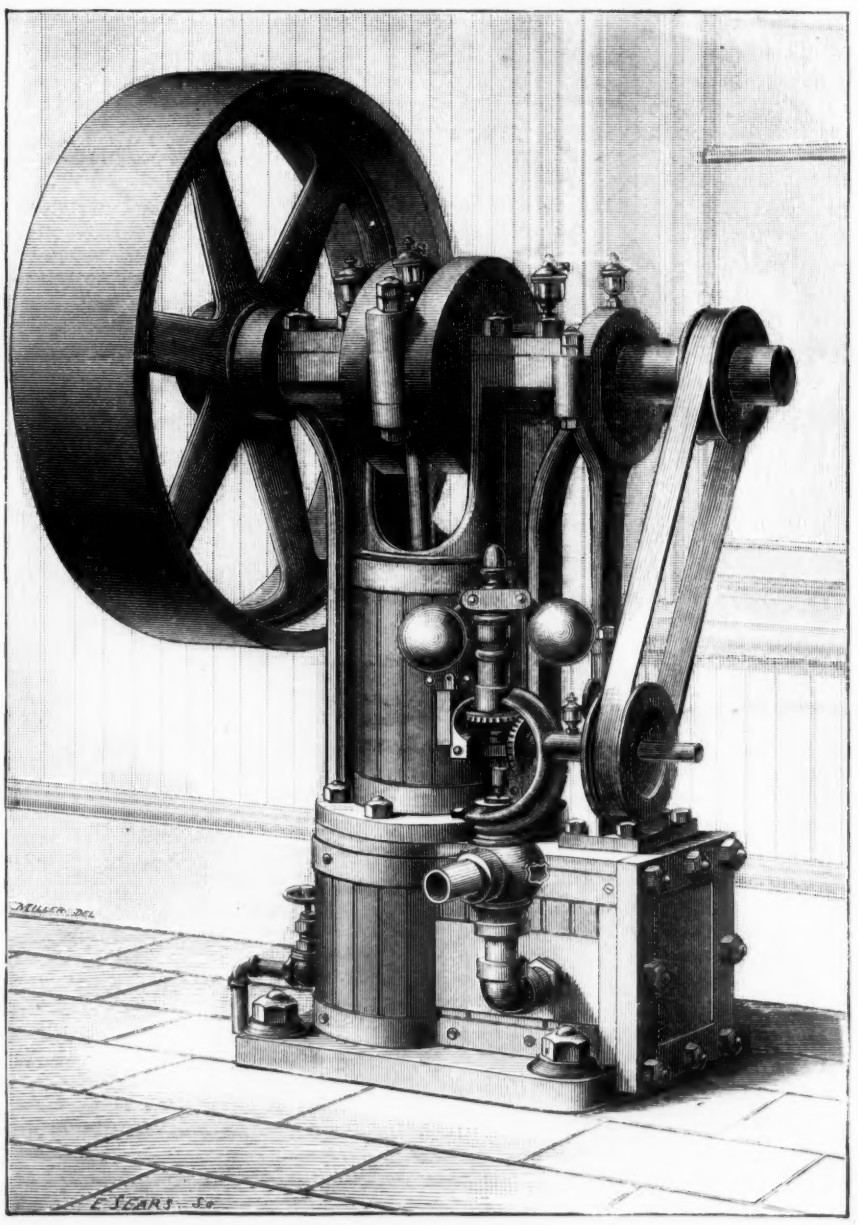
The valve is of the simple *D* form. It is driven by an eccentric which transmits its motion through the rod *Y* and stem *X* to the valve.

Any desired adjustment of the valve is effected by aid of the jam-nuts shown both above and below the valve.

The shaft, *F*, *G*, and crank-pin *H*, are of steel and the discs, *I*, *I*, of cast-iron.

Thus it will be seen that the compound principle is here made to advantage while retaining simplicity.

The annular space around the trunk is used as the high-pressure cylinder, and the enlarged area beneath the piston as the low-pressure cylinder.



MELVIN'S COMPOUND HIGH SPEED STEAM ENGINE.

The cross-head pin, *J*, *J*, has a square at the middle with corners rounded, and is held in place by being forced into its place and secured by a key (not shown) through the end *L* of the connecting rod.

One-half of the journals, *N*, *N*, are formed in the follower, while the lost motion is taken up by the caps, *O*, *O*, adjusted by the set screws, *M*, *M*.

This adjustment may be readily made from the outside by applying a wrench to the heads of the screws, and when finally adjusted may be secured by the jam-nuts, *Q*, *Q*.

The piston is made tight by the regular packing rings, *P*, *P*.

Lubrication of the trunk is effected by a fibrous material packed in the space below the junk ring *R*. It takes up the oil applied and feeds it gradually.

All parts of this engine are simple as well as accessible for inspection or repairs.

Main journals are lined with babbitt metal, and the crank-pin end of the main rod has the regular English style of connection. A drip cock conveys the water of condensation from the cylinder jacket to the waste. Pulleys are turned both inside and outside, thereby insuring an accurate balance.

The horizontal component of the connecting rod and crank-pin motion is balanced in the double crank discs.

The piston is made heavy for the purpose of absorbing power during the up stroke of the piston and to give it out on the down stroke, and in practice a point has been reached when the speed is high enough, where the piston acts in the same way as that of a simple single acting engine.

In other words, the pull is always in one direction, so that lost motion in the crank-pin and cross-head pin does not affect the quietness of its running. When the boxes are left loose so that the engine will pound at, say, 100 revolutions per minute, then let the speed be increased to 300 revolutions per minute, and the pounding will cease. When these parts have been properly proportioned this engine runs quite steadily.

The maximum expansion which it is considered prudent to use in this engine is claimed to be the equivalent of a cut off at one-fourth stroke in an ordinary engine, the use of a higher ratio of expansion entailing the use of too large an engine for the power developed.

This engine, we are informed, has given an economy of less than three pounds of coal per horse-power per hour, and from the fewness of its parts and its simplicity it may be worked at high rates of speed.

The indicator diagram represents the actual performance of this engine compared with its theoretical performance.

This diagram was taken from an engine of the following dimensions: Trunk, 7¼″ diameter; large cylinder, 9¾″; length of stroke, 6″; revolutions per minute, 230; scale of spring, 30 pounds to the inch: boiler pressure, 65 pounds. By calculating the horse-power represented by the theoretical diagram shown by the dotted lines, and comparing it with the actual work done, as shown by the full-line diagrams selected from a promiscuous lot taken from the engine while at work, we find that the difference between the two is only 1.016 horse-power. Or, in other words, that the whole loss from condensation and other causes is less than ten per cent. This engine was not intended to displace the ordinary tandem or Woolfe compound engine under ordinary circumstances, but rather to solve the problem of how to construct a simple, efficient, and at the same time economical engine of small power at a nominal cost; furthermore, to demonstrate the feasibility and advantages of developing power from steam distributed in pipes, as in the Holly and kindred systems.

Extracts from Chordal's Letters.

WHAT CONSTITUTES A DAY'S WORK IN A SHOP—FOUNDRIES FOR MAKING SPECIAL CASTINGS—TRIAL EXPENSES OF MACHINERY—CHORDAL'S PERSONAL EXPERIENCE IN TITLES AND DIGNITY.

Mr. Editor:

* * * Years ago, before I was born, a workingman, no matter what he did for a living, got up as soon as there was any use in getting up, and staid up as long as there was any use in staying up; and during this entire time he was supposed to be at work. And this time was called a day's work. The longest period actually measured that I have ever heard thus called a day's work was 16 hours.

After the world had grown gray on a day of this length, it was decided that it was hardly necessary for the working power of the world to labor during the entire hours of daylight; and by some very reasonable revolution, the fact was developed by actual

experience that the world at large could make a living by working 14 hours a day.

* * * Of the world's people most all are day laborers. The sole object of this labor is understood to be the earning of a reward in money for the purpose of supplying the necessities and luxuries of life. From my own standpoint I should say that the change from 16 to 14 hours a day simply gave the laborer that much more sleep. I can't imagine the workingman of yore spending his extra morning hour in pleasure or recreation.

The world moved on under the 14 hour plan, and it was thought that by the increased facilities afforded by labor-saving machinery, notwithstanding the increased demand created by the cheapening process of labor-saving machinery, a reasonable day's labor and a reasonable day's earnings might be gotten out of 12 hours a day; and 12 hours it became.

Where a revolution in system is so total, as a revolution must be in which all the laboring classes are involved, no hardship can be wrought on any class by increasing the cost due to a decrease in the working hours, for these matters are always self-compensating. The sellers of this world are also the buyers. When they sell higher they pay more, and can afford to. Aside from this there may be a gain by the worker, and no loss to the drone.

* * * While astronomy has ordained a length of time to be called a day, it has also ordained a condition of daylight which precludes a working-day, worthy of being called such, from being more than about so long. We know very well that a working-day 12 hours in length can't be had. From whatever cause it has arisen, another revolution has taken place, the third one, and by the laws of all reasonable lands 10 hours became considered a day's work.

* * * There is something reasonable and attractive about 10 hours as a working-day. At those seasons of the year when there is any comfort at all, there is a comfortable time between the christian rising hour and the blowing of the whistle. Work is over before any christian ought to eat his evening meal, and it is awful handy to figure it up in the shop. Ten hours per day are to 12 hours per day what dollars and cents are to pounds, shillings and pence.

* * * In our country there are peculiar conditions surrounding the laboring classes. The citizens are the laborers, and there are no high privileges which they have not a right to consider themselves entitled to. If there is any gain in a moral sense, and the aforesaid citizen-laborers think they can stand it financially, I see no reason why the hours should not be cut down to two per day. But the morals of the thing will hardly bear inves igation.

* * * Again a change, and now eight hours are by law a legal day when figuring labor in the absence of any more specific contract; but I am not aware of the existence of any-one at present willing to make equitable contracts based upon eight hours per day. I suppose everybody concerned thinks that it won't pay.

* * * If you hire a man in a machine shop for ten hours per day, are you supposed to hire the man's presence on the premises, or is it supposed to mean working time? Some shops get this matter down to a fine point, for when the morning whistle blows they expect the work to begin. I know of shops where every machine must start promptly on time, and I know of other shops where no attention is paid to this feature, and if a man is on the premises on time it is considered the proper thing

In a machine shop it always takes a man at least ten minutes to prepare for work after arrival. In other words, some shops allow a margin of ten minutes in the morning; and the men are generally smart enough to get another margin at night.

In some shops the entrance door is locked when the whistle blows, without any two or three minute grace about it. In other shops the entrance doors close five minutes after time.

* * * I once described to you, I believe, a machine for keeping workingmen's time in factories. This machine was operated by receiving admission tickets through a slot, and at, say, two minutes after commencing time, the slot closed with a bang and didn't open again for an hour. Here was the question of margin reduced to a nicety, though the margin was adjustable up to ten minutes.

* * * I have just had my periodical wrestle with Simpson in regard to starting a foundry. He uses lots of castings, but has never yet dirtied his hands by making them. Of course, he pays a price for castings which leaves a profit for the man he buys from; but if only this profit was the consideration, Simpson would hardly think of starting a foundry of his own.

Simpson in his business uses a great many chunks of iron of a certain peculiar size and shape, and he has never yet been able to find the foundry which would furnish them free from defect. There is a moulding problem

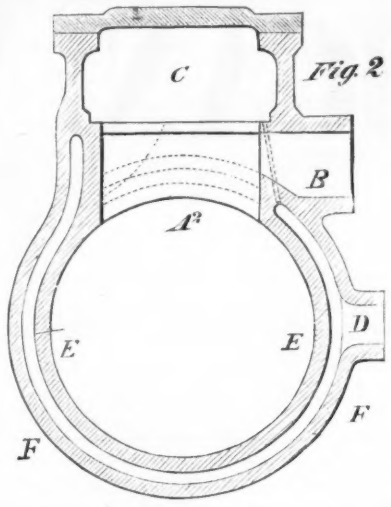
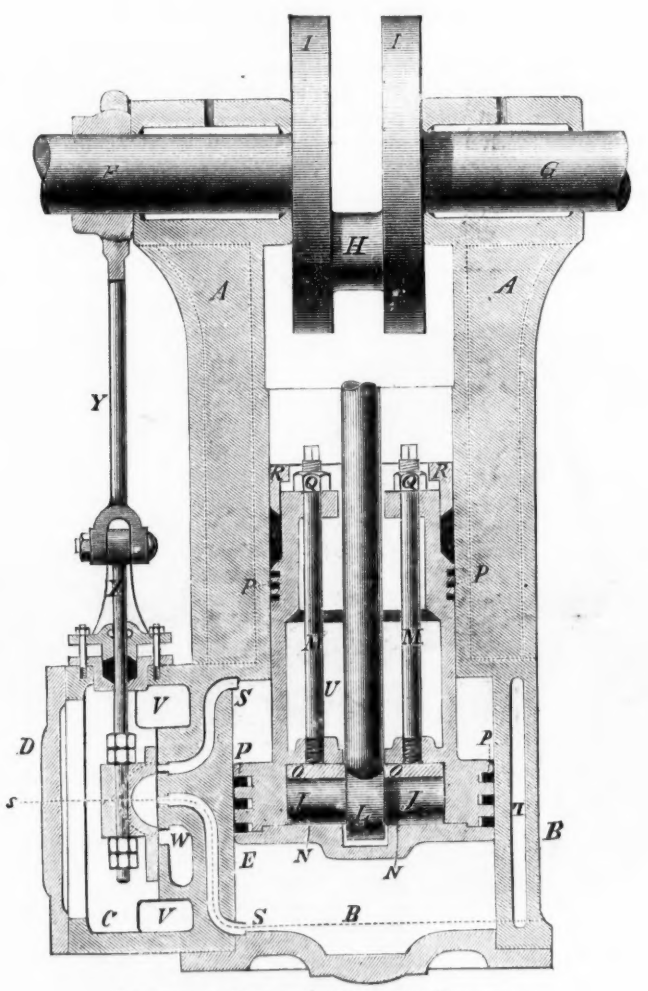
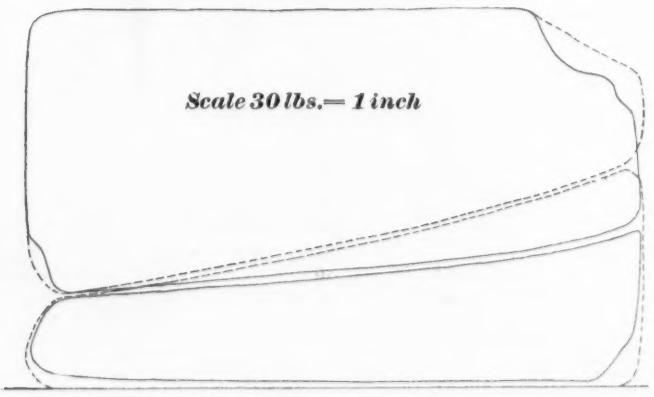


Fig. 2

Sectional Plan of Cylinder.



Sectional View of Melvin's Engine.



connected with these chunks, and after figuring at it a while, and after numerous failures, every foundry has abandoned the thing, save and except a single one 500 miles away. It never abandoned them and never fails. But freight and time play hob with this feature of the thing.

Another casting which Simpson uses in large quantities is a chunk of another peculiar size and shape, and presenting another problem of an entirely different kind. In this case also a single foundry a long distance away presents the only chance of getting the casting made. Simpson also uses lots of common castings.

* * * Mr. Simpson proposes to settle this whole matter by building his own foundry. He has already commenced on the foundation, and I tell him he is certain to put his foot in it. The case would be bad enough if he only intended to make his common castings; how much worse will it be when he deliberately runs amuck of two foundry problems whose solution offers no temptation to old established foundries anxious to get Simpson's business? It is a self-evident fact that in starting this foundry he must, at the very onset, go through the worry, trouble, and expense of learning how to make these two impossible castings.

I suggested that he save half the trouble, all the worry and expense, and accomplish his main purpose by means of moral suasion and a club, in some of the other foundries.

* * * Simpson's is the first case within my knowledge where an ordinary foundry has been constructed to do some sort of a job that other foundries have failed on. I am anxious to see how the thing will turn out. Come to think, though, I am under the impression that the Brown & Sharpe Manufacturing Company started their elegant and successful foundry from considerations other than mere foundry profit.

* * * Speaking of Simpson, he has a queer case on hand. I am always on the lookout for peculiar questions arising in the course of business. The case is this: Simpson builds a certain monstrous machine which cannot be tested in the shop. It gets its first start after finally being put up on the owner's premises. Among other things about this machine, there are two nicely surfaced plates, which lie against each other under certain pressures. These plates are not made exactly flat, but must have a trifle of concavity, in order to be flat when working under pressure. Practice and experience have told Simpson just about how hollow these plates ought to be, and the workmen know how to get the things up properly. These plates are vital points in the machine.

Simpson shipped one of these machines to a customer, with the usual guarantee of first-class material and workmanship Simpson sent his men, as per contract, to erect the machine and start its product to making. At the start the product was bad, and a search began for the cause. After three days' investigation it was found that the hollowing of the before-mentioned plates was not exactly right. They were at once returned to the shop, about 300 miles, by the way, where they were soon put into proper shape and returned. The machine then worked all right, and everything was satisfactory about it.

Thus far the entire procedure had not differed substantially from the procedure in all cases with machines of this class. But when it came to final settlement, Simpson found himself served with a bill for fuel and oil used in testing the machine to determine where the fault was.

* * * I believe that all first-class establishments usually follow the plan of inspecting, weighing, measuring, testing, and accepting or rejecting supplies and things contracted for. But I never yet heard of a contractor being charged with the cost of this service, or of any cost, unless he refused to cure the defects discovered.

Simpson's case seems analogous. It may become a matter of arbitration; and if on final decision the opinion of the court has anything of special interest in it, I will try and get Simpson to furnish me a copy.

* * * One of the most successful and refined mechanics in this country (now sick as I understand) has done me the honor to speak kindly of some of the "extracts" which you have heretofore made from my letters; and has done me a greater kindness by saying that a certain mechanic, whose history I gave you some details of some time ago, was no other than your obedient servant.

Such is not the case, however, and I only wish that I could find half as much good in Chordal's experience as is to be found in the history of this young man John. John was always full of the strengths of the trade.

I don't mind a frequent use of the personal pronoun, where it can be of service, and therefore do not hesitate to give an experience of my own, when I would keep mum about it if it was the experience of anybody else.

* * * Among young mechanics, who are not bankers' sons, there is always a peculiar envy of those who labor in offices and such like clean places. Lots of machinists, in their ignorance, would willingly trade places with some illy-paid clerk or salesman who he imagines has an easy and dignified position.

Once upon a time I was stranded in the city of St. Louis, and a happy thought came to me, that instead of looking for a job in a machine shop I might find a nice job at something else.

In the course of my investigation I found that the firm of L. M. Rumsey & Co., and a mighty good firm by the way, were in need of a shipping-clerk, and that with a reasonable amount of influence I might hope to get the place. I didn't know exactly what a shipping clerk was, but I knew it was something grand and lofty; the compound word had the ring of a title about it. I worked up the influence and got the place. Pay $1.50 a day. Pay in machine shop $3 a day.

I put on my best clothes and reported at the office of L. M. Rumsey & Co. after dinner. The Rumsey, or the company, I don't know which, handed me an iron cup, to hold water for a letter-press, and in a bluff sort of way said: "Here, take this and get some water in it." This was a good start. In the shop I had done ten thousand things at other men's bidding, but I had never yet been told to do it in so decided a manner. I went and got the water. What I did till night I don't just remember, but I do remember thinking a great deal of that water-cup during the night. The next morning the Rumsey, or the company, handed me a shipping tag and said: "Here, tie that on that bundle." I had tied many things before at the orders of other men, but I had never been ordered to do it in just exactly this way. The dignity of my position had not yet fully dawned upon me. What I did till night I don't remember, but I do remember at night thinking about the shipping tag. The next morning the shipping-clerk of L. M. Rumsey & Co. was working on a lathe in a machine shop. I never went after my pay, and I considered my experience in titles and dignity outside of machine shops to be cheap at $2.25.

* * * This reminds me that men often jump their jobs, and pay, too, for that matter, out of pure shame. I think of a case now of an excellent man, greatly given to extraordinary blowing about his fine abilities as a machinist, who, having done some ridiculous thing, stole his tools from the shop in the night, paid all his bills and jumped the town, and there are $30 or $40 to his credit on the books of that shop to-day.

* * * I once went to work myself in a railroad shop on the K. C., St. Jo. and C. B. and undertook a job of planing so far beyond my ability that I was glad to sneak out of the shop in the most undignified manner; and I have always been ashamed to go within fifty miles of that shop since. As near as I can remember the job it was nothing extraordinary, and I did no harm and no complaint was made, but I was so eternally long in doing it, or it seemed to me that I was, that I supposed I was making myself the laughing-stock of the shop. As I look back at it now, I suppose I did the job just as quickly as it is done in any railroad shop. But now I am so ashamed of having jumped the shop for any cause that I don't suppose I will allow myself to go near it.

I have known a timid man to go to work in a strange shop and sneak out in an hour and never come back, because he thought he had been guilty of doing something in a manner not usual in the shop.

* * * I stood by a lathe in a shop once and saw an old crony of mine—one of the timid kind—enter and ask for a job. He didn't know I was there, and I took care that he shouldn't see me. He got a job, and was set to work chipping a key-seat in a big gear-wheel. He drew his line, got a chisel to suit him, and setting down on a block grabbed his hammer-handle about half-way up and commenced chipping that key-seat in the most bungling manner in which I ever saw such work performed. The men, of course, watched him and grinned. The foreman took it all in, and told him instanter that he didn't want him any longer. I then interfered and brought things out all right. This man was one of the best chippers, and one of the best key-seat cutters that ever took hold of a chipping-hammer, but the new surroundings rattled him.

Very respectfully,

CHORDAL.

Last year more than six times as much grain was shipped from New York by steamships as by sailing vessels.

New Band Saw-Filer and Setter.

The accompanying engraving illustrates a combined saw-filer and setter, as made by Detrick & Harvey, of Baltimore, Md.

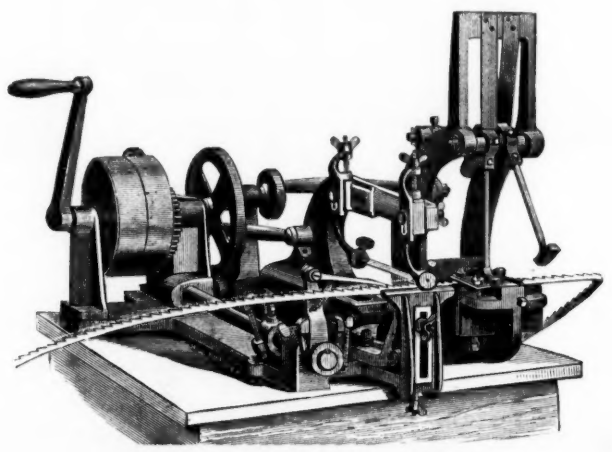
This machine has been designed with the purpose of imitating, as nearly as possible, the movements made in filing and setting band-saws by hand, but at the same time, to overcome the irregularities of hand filing, as shown by the high and low teeth in a blade after being hand-filed. An ordinary three-cornered file is used in this machine, varying in size according to the pitch of the saw.

Band-saws contain from 400 to 2,000 teeth, and it takes a first-class filer from twenty-five minutes to one hour and forty minutes to file one. This machine, constructed to work either by hand or power, will file and set a saw in from five to twenty minutes.

The head carrying the file has a forward and backward movement. In the forward movement the filing of the teeth takes place, and in its backward movement the file is lifted from the blade and drawn back, imitating exactly the movements of an expert filer.

The feed can be instantaneously adjusted to suit the pitch of any saw, and is arranged to feed one or more teeth at a time. The vise, in which the saw is held for filing, is adjustable to the thickness and depth of the blade.

The setting of the saw is accomplished by means of two hammers. The hammers



NEW BAND SAW-FILER AND SETTER.

are hung from an overhead shaft, and can be easily adjusted to any pitch of saw. The force of the blow can be at once regulated according to the thickness of the saw, or the amount of set required.

The anvil blocks of the setting attachment are also adjustable to all the varying conditions of saws. There is also an attachment for filing circular saws up to 20″ diameter.

The whole is in a compact form, standing on a suitable iron pedestal, and both the setting and the filing are accomplished by one machine, and, if desired, at the same time.

A Modern Machine-Shop Office.

The other day we walked into a machine-shop office finished and furnished in a style to remind the visitor of a drawing-room rather than a shop headquarters. It was the new office of the Niles Tool Works, Hamilton, Ohio. There are three apartments. In the front room, 18x15 feet, the shipping clerk and timekeepers perform their duties. In the center room, 12 feet square, the bookkeepers have their posts. The inner chamber, 18x15 feet, is the sanctum of General Manager Alexander Gordon and Secretary R. C. McKinney. Close at hand are three small electrical knobs. Upon touching one, the foundry foreman appears; another calls the general foreman of the shop, and a third calls the office messenger boy. The ceilings are 12 feet high, and the inner room is tastefully finished in black walnut, with old-gold wall paper, enameled glass windows looking into the center office, and the floor elegantly carpeted. An æsthetic bronze match-safe, contributed by "Chordal," is one of the articles of furniture. One door leads from the front room and one from the inner room to the 10x12 feet fire-proof vaults, with 14″ brick walls. Here is a burglar-proof safe with a new style of door. Fifty or sixty compartments, each with a door, cover the walls on every side. The books, correspondence, drawings, &c., of the establishment are systematically placed in these compartments, so anything desired can be found at once. Wood-cuts and electrotypes are laid upon sliding shelves. Electric call knobs are provided also for the front and middle rooms. All the arrangements are well devised for convenient conduct of a machinery-building establishment employing 300 workmen and running 23 hours out of 24 every working day, as has been the case for many months past.

Peter Cooper, the Philanthropist.

On the 4th instant, at his home in New York City, died the most widely known and most universally esteemed and honored citizen of the United States, the great philanthropist, Peter Cooper, at the age of ninety-two. The story of Peter Cooper's life has been often told, and his portrait is familiar to almost every school-boy in the country; yet no biographical sketch, no matter however well written, can do full justice to the subject. Mr. Cooper's life is worthy of study by the young men of America, and doubtless some book publisher will undertake to supply the demand for a volume embracing the most salient features of his career.

"I was," said Mr. Cooper, "born on the 12th of February, 1791, when New York City contained only 27,000 inhabitants. My mother told me often about the fear she had in her youth of the Indians, who were settled in the same spot where now the former down-town store of the late A. T. Stewart stands, near the City Hall. My father was a brewer and a lieutenant in the revolutionary army, and after peace was established he began a hat factory, in which I was employed as apprentice. My father had a large family, and I had to assist in their support, so that I could only attend school for one year, and then sometimes only for half a day. All knowledge which I have acquired since that time is due to my own efforts to study without the help of any teacher. When seventeen years old I entered an apprenticeship with a carriage maker, and my master was so satisfied with me that he offered to assist me to commence a business for myself. I refused, however, and invented a machine soon afterward for shaving cloth, which was exceedingly profitable during the war of 1812, but after the peace it became worthless. Then I opened a grocery store, and subsequently became a glue manufacturer, which business I have pursued for forty years, and which is now continued by my son, son-in-law and nephews. This business has since its establishment become so extensive that at present twenty tons of coal per day are consumed for the boilers, etc., one thousand barrels of glue are produced per week, besides a large amount of neats-foot oil and other by-products.

"In 1830 I built in Baltimore the first locomotive on the American continent, for the Baltimore & Ohio Railroad, which had been chartered in 1827, and for which Charles Carrol of Carrolton, one of the signers of the Declaration of Independence, stuck the first spade in the ground, while he was then ninety years old. After I had finished the locomotive, I made a trial trip to Ellicott's Mills with the same, having one open car attached, containing the directors and other prominent citizens as passengers. We made the distance of fifteen miles in one hour, and returned with about the same speed, to the great satisfaction of all. So you see that I was myself the engineer, builder and driver of the first American locomotive."

Peter Cooper's father was an ale brewer, and afterwards a brick-maker, at which latter occupation he failed, and again started a brewery in Brooklyn. At both of these trades young Peter worked hard. In 1808 he came to New York City to begin business as a brewer on his own account. He essayed to make a better quality of ale than any other brewer, but for want of capital was obliged to give up the enterprise. Then he was bound for five years to a coach-maker at $25 a year and board. In the course of this apprenticeship he developed traits of character which aided him to advance beyond his fellow-apprentices. He would not join in orgies at the tavern, but spent his leisure hours in study and experiment. At the age of twenty-one his apprenticeship expired, and Mr. Woodward offered to lend him capital to start up a shop on the Bowery, but he declined to borrow. He had abhorrence of debt, which never weakened during his whole career. His first success was with an improved cloth shearing machine of his own invention during the war of 1812. After the war he started a grocery store on the site of the Bible House, opposite he present Cooper Union. After three years' work as a grocer he sold out, and started a glue factory, which proved the basis of his large fortune. At that time Irish glue was the best in the market. He made a quality of glue superior to the Irish, sold it at a better price, and drove the foreign article out of the market. The glue factory is still running in Brooklyn, E. D.

In 1828 he joined two men in purchasing 3,000 acres of land near Baltimore. His two partners proved to be adventurers without capital, and he bought them out promptly, built the Canton Iron Works, and made the property valuable by improvements. Next he sold out this property, taking shares of the iron-works in part payment. Following this he started an iron-works in New York City, and in two or three years moved it to Trenton, N. J. This was the foundation of the large works of Cooper, Hewitt & Co., of that city. At these works was rolled the first iron beams for architectural purposes in America. Mr. Cooper was the first to apply anthracite coal to the puddling of iron. He took an interest in various manufactories of iron and wood-work in New Jersey and Pennsylvania. It is worthy of note that Mr. Cooper was an earnest advocate of the protective tariff, as helping to develop the natural resources of our country, and that he wrote several pamphlets upon that subject.

In 1855 Mr. Cooper begun the building of Cooper Institute at the junction of Third and Fourth avenues and the Bowery, New York. This institution realizes the greatest ambition of his life. He had often felt the need of education himself, and determined to found an institution where the youth of both sexes could obtain free instruction in those sciences that would prove of greatest value to them in earning a livelihood.

In 1857 the Cooper Union was opened, and day and evening schools have been maintained for eight months every year since that time.

Mr. Cooper has spent considerably over a million dollars in building and endowing that institution. Recently an additional story has been erected, and the Inventors' Institute domiciled within the structure A permanent exhibition of machinery and mechanical appliances is kept up. There are now over 2,000 students in the evening schools, and many thousands have graduated and gone out to take responsible positions.

Mr. Cooper was a prolific inventor, and has given to the world many improvements upon former mechanical devices. He believed in self-reliance, and advised young men to push ahead with confidence in their own abilities. He held that every encouragement should be extended to ambitious and deserving men, and made his principles apply to the State and National governments as well as to individuals of means and influence. He used his large wealth for the good of his fellow men, and died without enemies and universally honored.

Expansion and Reversing Valve-Gear for Steam Engines.

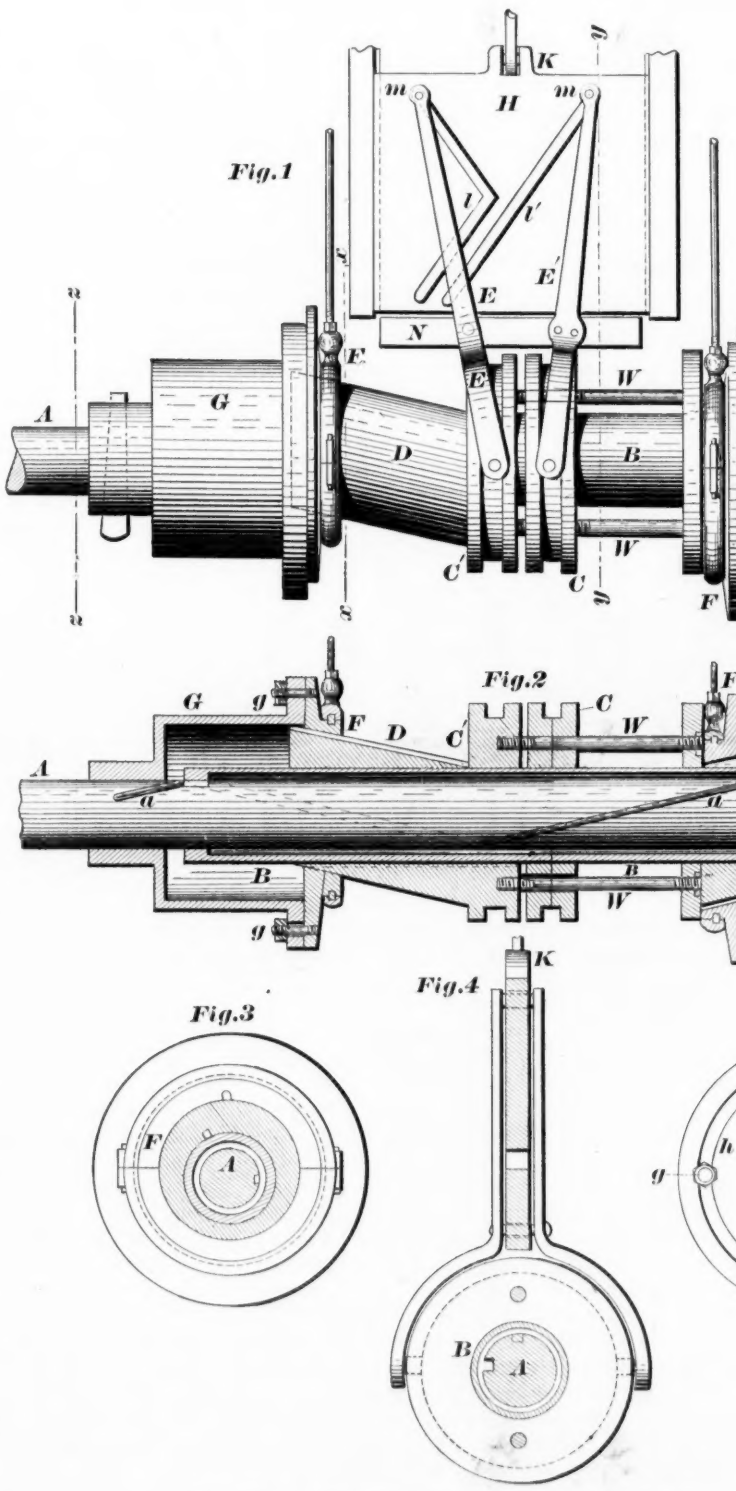
Dissatisfaction with the link motion, as a means for working steam expansively, has found frequent expression in attempts to provide a substitute for it, one of which is represented in the accompanying engravings. It is claimed for this arrangement, which is the invention of Frederick Rock, of Homer, N. Y., that it possesses all the advantages that have made the link motion popular in spite of its defects; that its first cost is no more than that of the link motion; that the cost of maintenance is much less, and that its essential parts are simple in construction and not subject to derangement from wear and other causes to the same extent that the corresponding parts of the link motion are; also that desirable purposes can be accomplished by its use that cannot be accomplished by the use of the link motion.

Referring to the engravings, Fig. 1 is a plan, Fig. 2 a longitudinal section, and Figs. 3, 4 and 5 cross-sections, on lines *x-x*, *y-y* and *z-z*, respectively. These figures together represent the application of this valve-gear to an ordinary locomotive engine, its application to any other form of expansion and reversing engine being similar, except as to unimportant details.

A represents the driving shaft, in which is cut the spiral groove *a*. To this shaft a sleeve *B*, is fitted to be moved longitudinally, and at the same time to be partially rotated by means of feathers attached to the sleeve and fitted to the spiral groove in the shaft. This sleeve has an enlarged part or collar *C*, with a circumferential groove adapted to receive the lugs of the shifting lever *E'*, by the operation of which it is moved backward and forward on the shaft. *D*, *D'* are sleeves having holes oblique to their outer surface. These sleeves are arranged to slide freely on the sleeve *B*, being restrained from turning by suitable feathers and grooves. The sleeves, *D*, *D'*, are rigidly connected together by means of the rods, *W*, *W*, which pass freely through holes in collar *C*, as shown in Figs. 2 and 4, and are moved on the sleeve *B*, by means of the lever *E*, which engages for the purpose with the collar *C'*, of sleeve *D*.

The holes through eccentrics *F*, are oblique to the axis, to correspond with the obliquity of the exterior surface of the sleeves *D*, to which they are fitted so that the latter may be passed forward and backward through the former, while their relative position with reference to rotation remains constant.

G, *G*, are shells keyed fast to the driving shaft. They are made with flanges provided with slots *h* (Fig. 5). Standing bolts *g*, are made fast in the eccentrics, but move freely in the slots mentioned. The object of this construction is to permit the eccentrics (together with sleeves *B* and *D*, to be rotated a determined distance on the shaft without their (the eccentrics) being moved longitudinally. Further than the peculiarities described, the eccentrics do not differ in their construction and arrangement from those in common use, being connected with the valves in any way best suited to the conditions. From the engravings, and from the preceding description, it will be seen that moving the sleeve *B*, endwise on the shaft will cause the eccentrics to rotate in a direction corresponding with the direction in which the sleeve is moved, but that, aside from this partial rotation, all the sleeves, together with the eccentrics, revolve with the shaft, maintaining always their relative positions. This partial rotation of the eccentrics is for the purpose of changing their angular advance to correspond with different valve travel and points of cut-off, or for reversing the direction of motion. It will also be seen that moving the sleeves, *D*, *D'*, on the sleeve *B*, or together with it, will have the effect to change the eccentricity or throw of the eccentrics, the angular exterior surface of the sleeves, *D*, *D*, serving as cams for this purpose, and that, by a proper combination of these movements, the angular advance of the eccentrics and the travel of the valves may be made to correspond with the fixed lap of the valves for any desired cut-off, as well as for motion in either direction. To accomplish these ends, the part *H*, technically termed a rack, is employed.



Expansion and Reversing Valve-Gear for Steam Engines.

This is a rectangular piece of iron, arranged to be moved forward or backward on suitable guides, by means of the lever connection *K*, which extends to the cab in the usual manner. Through this rack slots, *l*, *l'*, are formed, and to these slots anti-friction rollers, *m*, *m*, on the ends of the levers, *E*, *E'*, are fitted. These levers being pivoted to part *N*, it is apparent, if the slots extend in any other direction than parallel with the line of motion of the rack, that when the latter is moved in any direction provided for, the ends of the levers will be influenced to move the sleeves *B*, and *D*, *D'*. It is only necessary to provide for regulating the relative position of the parts described to accomplish the purpose desired, to give these slots the necessary direction.

It is likewise apparent that, by the use of this arrangement, and by a predetermined construction, the lead of the valves may be maintained constant for every grade of expansion, or that it may be made to increase to any desired extent as the expansion is increased; also that, by a slight modification, the lead may be made quite independent of other conditions, and varied at the will of the engineer. This enables the lead to be made as is found best for the class of engine (whether freight or passenger), or where the engine has to do both freight and passenger duty, it enables the engineer to run with the lead best suited to the conditions under which the engine is running.

Another feature incident to the use of this valve-gear is, that the eccentrics are not forced out of round by the use of set-screws, but remain in use in the condition in which they leave the lathe. Still another: the eccentrics are held in the positions to which they are shifted, against the possibility of slipping, thus obviating a very serious source of trouble and inconvenience.

None of the parts of the shifting device are in motion, except when moved to vary the expansion or to reverse the engine, and consequently are not subject to the derangement of constant wear, resulting in imperfect action. But two eccentrics are required for a double engine, and the wearing parts are only such as are required to connect the eccentrics with the valves.

This valve-gear is under the control of William F. Hitchcock, Homer, N. Y.

Steam Pistons.

By Chas. A. Hague.

It may be truly said that the piston is the heart of the engine. An injury befalling it, which might not be serious in some other part, renders the whole useless.

The engine may be of good design, and may embody the least possible metal most judiciously distributed; the valve gear may be perfect in operation, and possessed of the most enduring qualities, but if the piston is not perfect in its qualifications as a piston, the usefulness of the entire machine is proportionately impaired.

The office of the piston is to furnish a steam-tight barrier that shall move with the least possible friction. If the cylinder and piston could be made perfectly round and true, the piston could be fitted just loose enough to move freely, and no packing whatever would be required. The only friction in such an arrangement would be that due to the weight of the piston and rod end in a horizontal engine, and no friction at all would be perceptible in a vertical cylinder.

But, first, the defects in practice, and, second, the wear of the metal in use, render packing necessary; hence, a piston consists of two principal members—the piston body and the packing. The friction of the packing depends upon the pressure exerted against the rings to produce a steam-tight joint against the cylinder walls, and is independent of the amount of wearing surface presented by the rings.

Of all the details pertaining to steam engines, there are none in which simplicity, durability and certainty are so much demanded as in the piston; and it may be set down for a fact that the simplest piston is the best. A plain, movable diaphragm accurately fitted, and with two or three grooves around its edge, would answer every purpose if it were not for the wear of the metal; and the nearer we can approach this device in simplicity and effect the less trouble there will be experienced with steam leaks within the cylinder, and also with cutting and wearing; in addition, the cost of lubrication will be reduced to a minimum.

Make the solid part of the piston so as to secure ample wearing surface, and remember that a thick piston, if properly designed, furnishes a greater proportionate surface for the support of its weight than a thin one. The solid part of the piston, or the piston proper, is to be considered entirely separate with reference to strength, wearing qualities and general arrangement from the elastic or packing portion. The packing in a piston is simply a concession to our inability to make and preserve a perfect and correct piece of workmanship.

With a piston fitted sufficiently close to prevent shaking—say, $\frac{1}{64}''$ slack in the cylinder—the pressure required to hold the packing steam-tight against the cylinder walls is very slight indeed, and in very many pistons the opportunities and conveniences are entirely too good for jack-screwing the rings hard out against the bore. One of the very best forms of piston known is a plain disc with a thickness equal to one-fourth of its diameter (hollow, if desired), fitted just a little slack in the cylinder, and provided with a single packing ring, whose width shall be about one-sixth the thickness of the piston, held outward by light springs of flat steel that can be put in place with the fingers. The ring is made just a tight fit for the cylinder, and when cut will fit in a manner

that leaves nothing to be desired. The joint at the parting of the ring is made by a small "keeper," held in place by one of the springs. Such a piston, if slightly lubricated and let alone, need not be meddled with for a year at least.

In horizontal cylinders the bottom third of the piston's surface only is available for carrying the weight. This surface, for an equal thickness of the disc, and for varying diameters, is in direct proportion to the diameter; but for solid discs the weight would vary as the squares of the diameters. For example, a disc 20″ inches diameter, 1″ thick, would present twenty square inches of surface for wear, and a disc 40″ diameter, 1″ thick, would give forty square inches, but the weight of the large disc would be four times that of the small one; hence, the pressure per square inch for friction would be doubled. From this it appears that the friction increases in greater ratio than the diameters of the pistons, unless proper provisions are made to specially adapt the speed and area of surface to suit the case.

In some types of large engines the piston rod is carried through the back cylinder head, and travels in a bearing calculated to afford ample supporting surface in a position where it can be easily lubricated, thus relieving the cylinder and piston. In vertical and beam engines the friction of the piston head, independent of the packing rings, should be entirely obviated, and when the rod travels in a straight line the friction is practically prevented; that of the packing must, of course, be endured in any case. In engines upwards of 24″ diameter of cylinder, the vertical form is unquestionably to be preferred, as far as wear of piston is concerned; the integrity of the piston, together with the cost of its lubrication and repairs, being very important considerations in operating steam engines.

Whatever detractions the vertical engine has, the durability and economy of piston duty are certainly in its favor, and in summing up the case for or against it the engine should be looked at in the light of an investment of capital, the interest upon which, and the cost for steam, lubrication and repairs, must come out of the earnings of the establishment it furnishes power to. Its bill for interest is greater than the same power horizontal engine, but among the larger sizes the other items are in its favor, and in ten years' run the type which calls for the least drain on the profits is the one to be desired.

The main principles, then, of piston construction are to have the cylinder bored true, and the body of the piston fitted to have its own bearing independent of the packing, and the packing employed simply to make a tight joint.

If this is properly done, and the packing not too tightly forced outward, the bore will wear well, provided dirt is kept out and good oil is kept in. The practice of trying to keep the piston off the bottom of the cylinder, and have it ride on narrow rings, is most pernicious, because it only transfers the friction from a large to a small surface, the result of which must be obvious.

Lindsay's Cutting Nipper.

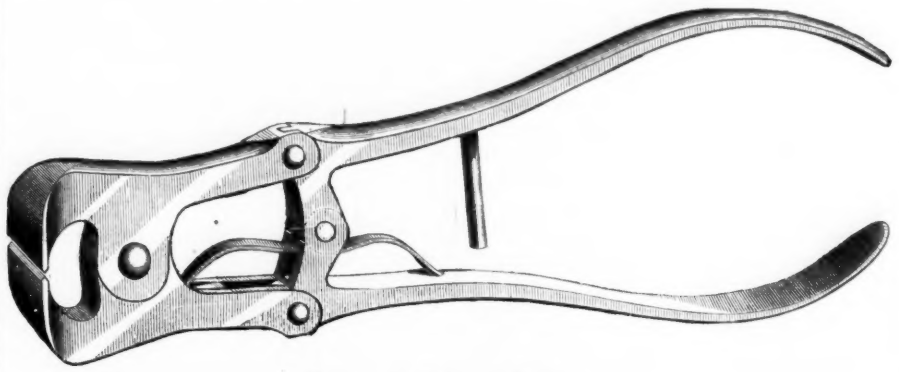
The engraving herewith presented represents a new cutting nipper, designed for the use of machinists and others requiring tools of this class. The noticeable feature of this nipper is the employment of the toggle joint, by which the cutting force is greatly increased as the nippers are closed on the piece being cut. By this means the cutting edges may be given a regular closing movement, avoiding the usual destructive twisting motion which soon breaks and destroys them.

The four principal pieces of which the nipper is made are of steel, and are made by the use of jigs so that duplicate parts can be ordered at any time for repairs, with the certainty that they will fit. The pin prevents closing the cutting edges one against the other. The simple spring by which the cutting edges are held open can be replaced without taking the tool apart.

These nippers are being introduced by S. A. Smith, 154 Lake street, Chicago, Ill.

Vertical Speed Drill Press.

The engraving on this page represents the vertical speed drill, manufactured by the Gaylord, Cross & Speirs Co., Waterbury, Conn. This machine is designed for light drilling where high rotative speed is required. It is entirely self-contained, requiring no countershaft, but may be placed anywhere convenient to line shaft, and either parallel with or at right-angles to it. It is



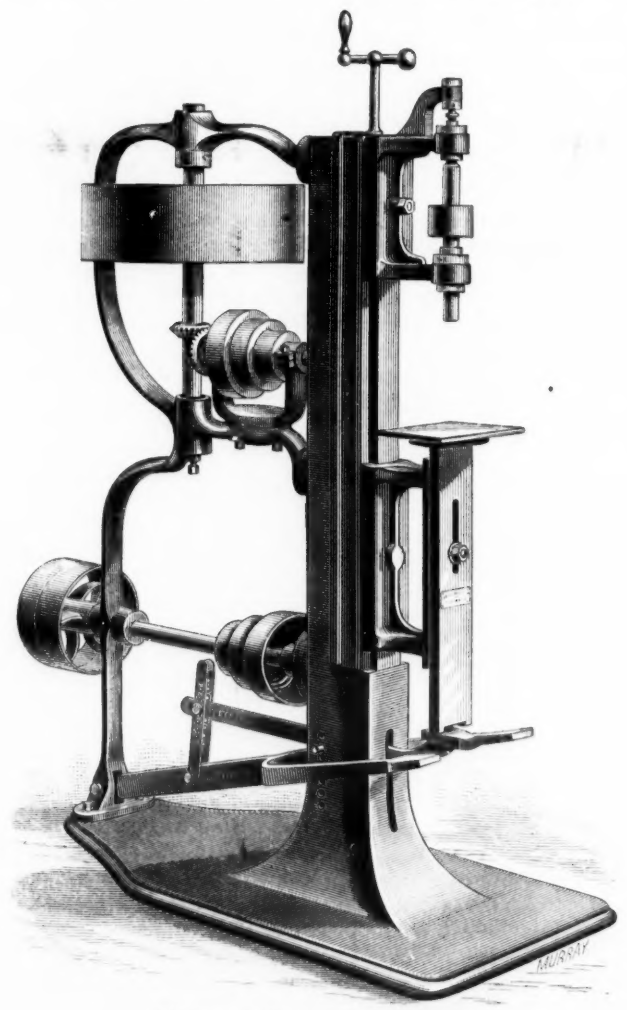
Lindsay's Cutting Nipper.

provided with a heavy broad base to adapt it to stand steady at high speed.

The spindle is driven from the large balanced band-wheel shown, by which means a high speed is given to the drill while the miter gears run at a very moderate speed.

The treadle is adjustable to a position most convenient for the operator, this adjustment being accomplished by changing the pins in the holes in the base and treadle connection.

The lower head can be lowered or raised as required to suit the work, and the motion



Vertical Speed Drill Press.

of the drill plate regulated by a stop. The upper head has a vertical adjustment, which avoids the necessity of frequent changing of the position of the lower head. This adjustment is convenient in drilling holes of different depths, as by using the stop motion the head can be quickly adjusted to drill any required depth, by means of the handle shown on the top.

The upper end of the drill spindle is shaped like an inverted cone, is hardened, and bears against a hardened step. A brass thimble or ring serves to retain the oil, thus providing for constant lubrication. The spindle bearings are straight, the boxes being cut open on one side and adjusted by being drawn into taper sockets by suitable nuts.

The end of the upright shaft runs in an oil well. The weight of this machine is about 525 pounds.

The Truth in a Nut-Shell.

The papers all over the country are crying out for railroad reform, but as long as the average legislator has his pockets filled with railroad passes and other valuables received from the railroads, the result will be pretty much the same as was the verdict in the hog-stealing case, where nine of the jurors and the prosecuting attorney had had some of the stolen pork.—*Texas Siftings.*

Endowment Fund for Columbia College.

The trustees of Columbia College, New York City, in making public a detailed report of the financial condition and prospects of that institution, ask for an endowment fund of four millions of dollars, producing a net income of two hundred thousand dollars per annum, as a means of transforming the college into a university worthy of its name and location in the heart of the metropolis. As part of this comprehensive plan, it is desired to raise an endowment fund of $200,000, producing $10,000 per annum, to sustain the sanitary engineering department, recently decided upon. For the proposed department of electrical engineering, a fund of $250,000 is wanted, producing $12,500 per annum.

Jacob Reese, Pittsburgh, Pa., says he is able to melt instantly a bar of cast steel one inch in diameter—which cannot be fused in less than five minutes in the highest furnace heat attainable—simply by throwing against it a column of air having a velocity of 25,000 feet per minute.

Condition of the British Iron Trade.

Iron, of London, in a recent leading editorial on the British iron industry, says:

"If the quantity of work turned out in the iron works, foundries, and engine shops of the country were the sole element to be considered, 1882 would rank as the most prosperous year on record for the iron trade. During it there were exported from Great Britain upwards of 500,000 tons of iron and steel more than was ever before sent abroad in any one year; the value of the railway carriages and wagons shipped was almost three times as great as that for the preceding year; the hardware and cutlery delivered for foreign consumption was worth £230,000 more than in 1881; while in machinery and millwork the improvement was also very marked. Of steam engines, there were shipped £3,562,088 worth in 1882, against £3,166,920 worth in 1881; and the value of other descriptions of machinery, was £8,400,572, against £6,793,286. These figures show that not only were the quantities of iron and steel directly exported exceptionally heavy but also that great activity prevailed as regards other manufactures into which these metals enter either wholly or in part. In at least one department of home trade, viz., shipbuilding, corresponding activity was manifested, and in view of the large amount of tonnage launched the quantity of iron and steel consumed in this direction must have been greatly increased."

The article proceeds to point out that in spite of this active trade the prices of iron fell almost continuously during the year. Some consolation is found in the fact that exports to foreign countries, with the exception of the United States, are on the increase. It continues thus:

"In spite, however, of these rays of hope, so far as the foreign demand for our iron is concerned, we are reluctantly forced to the conclusion that in view of the diminishing wants of the United States, the best days are past for the present, and that the high total of exports attained last year will not be reached in 1883. And, unfortunately, the condition of the home trade is not such as to lead us to look for any increased consumption through that channel. The prospects of agriculture cannot be called brilliant at present, and any disaster in that quarter could not but have a bad influence on the iron trade. Shipbuilding has been very active for some time past now, but here again we are met with the uncomfortable reflection that prices of shipbuilding iron fell last year in spite of the unusually large amount of tonnage which was turned out. If, therefore, even the same rate of construction is continued, there seems to be no prospect of better prices for ship plates and angles."

The conclusion of the review is not assuring for our cousins on the other side of the Atlantic. It openly declares that "less prosperous times than the last two or three years are now before the iron trade."

The Cost of Stopping a Train.

This is a problem which may possibly be cleared up one of these days, but just now the outlook in that direction is not promising. The best plan would seem to be to get a large number of experienced railroad men to guess at it and then average the guesses. This would be an approximation near enough, perhaps, for all practical purposes. Any one who will figure the cost of stopping a passenger train down to the fraction of a cent, and then prove his figuring to be correct, will beat the weather prophets all to pieces. A very little reflection, however, ought to satisfy any rational mind that it is quite impossible to disentangle and separate all the elements of cost that enter into the stopping of any particular train from the various elements of cost involved in the general operations of a road. There is manifestly no dividing line by means of which the former can be eliminated with any degree of precision. The basis upon which to work in order to arrive at an approximate result is more unreliable than that upon which the mileage cost of transporting

freight is estimated, and apparently of much less importance. It is a problem, as it seems to us, that is more speculative than practical. The making of stops by railroad trains is a necessity, no matter what the cost may be. The cost of the regular stops of passenger trains is probably about as little as it can be with due regard for the interests of the traffic, and if such cost could be ascertained with absolute certainty for each and every train, it would amount to little more than a curious piece of information.—*National Car Builder.*

LETTERS FROM PRACTICAL MEN.

Care of Tools—New Scraper Tool.

Editor American Machinist:

It has been said that the poorest and least-taken-care-of tools which a man possesses are those which he uses in his daily occupation—those upon which he depends for a livelihood. Observation teaches that this is true as a general rule, the exceptional cases being always those of first class mechanics. There is such an antipathy to the labor required to put a tool into good order that few mechanics—even good mechanics, sometimes—take the trouble to put a tool into good shape until it acquires the admirable qualities of a balky mule.

Then they will push, and grunt, and squeeze, and vainly attempt to *make* it go, wasting far more time than would be required to put the tool in a good condition.

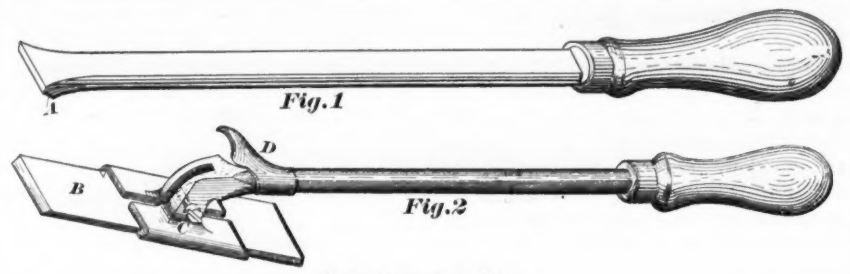
It has also been said that a good mechanic can do a good job even with poor tools. How much truth there may be in this is uncertain, but it is true that good mechanics rarely possess poor tools when they can possibly obtain good ones. The quality of a mechanic can be quite accurately judged of by the quality of his tools. The poorest mechanic usually has few or no tools at all. He plods along somehow by resorting to the abominable and disgraceful practice of borrowing. Next to learning how to use a tool, the apprentice should learn how to keep it in good working order. It is a real pleasure to work with a good tool. The work can be done in less time, and better work can be produced with less fatigue. It is one way of "making haste slowly." The saving of muscles and temper will repay the operator well for the time spent in putting his tools into a mechanical shape (provided he does not have to lend them to some one who never has any tools of his own).

We were told not long since by a scraper that scraping made his arms ache. Scraping is rather fatiguing to the muscles of the arms, but after seeing the tool this man used we did not wonder at his complaint, but were rather surprised that he could accomplish anything at all. The tool is represented in Fig. 1, and was ground as shown at *A*. Further comment is unnecessary.

If we would take a little more time and pains, and *design* our tools for the purpose for which they were intended, we would often save a great deal in time, material, labor, and consequently money. The tool above referred to is clumsy, unsightly, contains quite a stock of steel, and it must frequently be taken to the tool-dresser to have it drawn out and tempered.

There would undoubtedly be an advantage gained by replacing this tool by the one shown in Fig. 2, the construction of which is plainly shown by the engraving. The plate *B*, is simply a piece of steel cut from a flat bar and tempered, the edges being previously beveled a little with a file to fit the holder *C*. This forms a neat scraping tool. It can be made quite light, and requires no tool-dresser to dress it. The plate *B* can be replaced by a new one at any time without the expenditure of much time, blacksmith help or steel. The hand rest *D*, will be a convenient addition to the tool-holder, and can be readily made and soldered to it. For the benefit of those using such tools, this design is respectfully submitted in the belief that a trial will demonstrate its utility as a labor-saving and convenient device. Gus.

Providence, R. I.

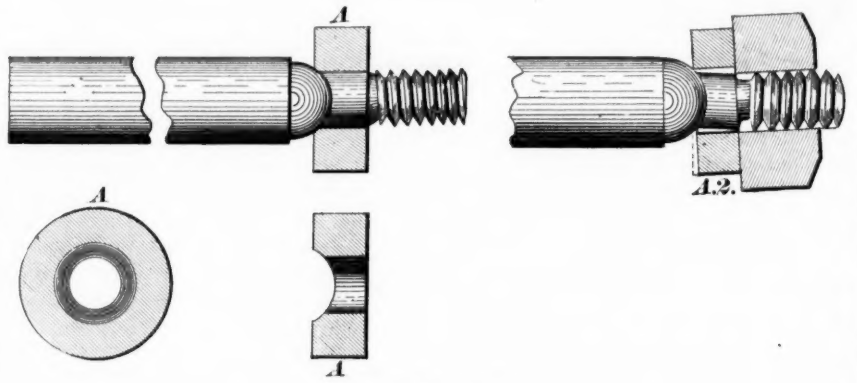


New Scraper Tool.

A Nut Mandrel.

Editor American Machinist:

I send you sketch of a mandrel for squaring up nuts true with the thread when they are not tapped square with the face. It will be seen that beyond the thread of the mandrel is a rounded or "ball" shoulder, and a corresponding collar *A*, which should be bored a little larger than the mandrel. A nut that is not tapped square will assume the position shown at *A*.2, squaring itself by the thread, whether out much or little. There is no "patent right" about this, any one being at liberty to use it. Kinks.

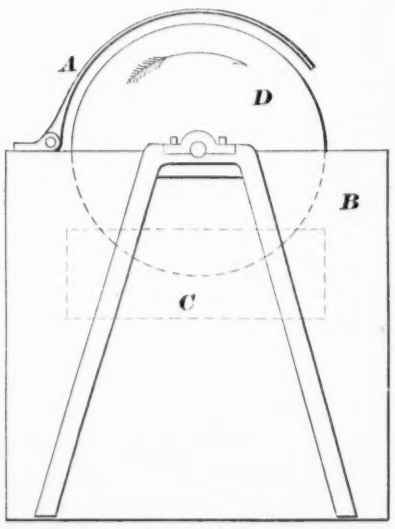


A Nut Mandrel.

Protection Against Dust from Emery Wheels.

Editor American Machinist:

I enclose you a rough drawing of something I have found very serviceable in protecting a workman on an emery wheel from the dust. *D* represents the emery wheel, around which I build a tight wooden box *B*. To this box is hinged a cover *A*, which can be opened back when desired. *C* is a box which is filled with water, so that the wheel just clears it. The operation is simply this: The dust follows the direction of the wheel,



Emery Wheel Dust Guard.

with a tendency to fly off, and when it comes to the water it don't fly any more.

This arrangement has been a perfect success with me, and, as will be seen, it has the further merit of costing but a trifle.

John W. Hartness.

Pillow Blocks without Quarter Brasses.

Editor American Machinist:

The article on Pounding in Steam Engines, in the American Machinist of April 7, reminds me of my experience in the direction of journal boxes. I had the job of setting up and running a horizontal engine, and when I came to see the engine I found that there were no quarter brasses in the main pillow blocks, they were no more in fact than plain babbited journal boxes. I thought and said some very uncomplimentary things about these boxes, but there was no help for it—nothing but to put them up and use them.

On digging for the foundation, the ground did not seem as firm as was desirable, and the space was enlarged and open cross-timber work was put in, and then the open spaces were filled with earth and well pounded down, and the stone work was placed on that, the foundation bolts passing through to the bottom of the timbers.

Great care was taken to have just as good a foundation for the outer end box as the inner one had. Mistakes are often made in thinking that any kind of a cab-house will do for an out-board bearing. I tried the boxes on the shaft, and not finding them satisfactory I re-scraped them, and left out the card-board liners and put in good hard-wood liners, and then set the engine, the boxes and the shaft just as near to perfection as I knew how to do it.

Before putting on any load, I run the engine light, and dressed down the liners of the boxes, or put in thicker ones as occasion required, until the shaft would run perfectly still and yet not heat, with the bolts screwed firmly down; and for three years, at least, and I do not know how much longer, that pillow block caused as little trouble and made as little noise as any quarter-box pillow block that I ever handled.

Pullman, Ills. M.

Foundry Theories and Experiments.

Editor American Machinist:

In your issue of the 10th instant, Mr. West replies to what he terms "a racket" received from me last August. First, he says I take exception to his "theoretical realm," and that because he made certain things very plain I was greatly exercised over them. Now, if I remember correctly, the gentleman in the article I replied to said he intended to make some experiments to make his subject plain; or, in other words, to find out what he was writing about. That is why I (in all kindness), suggested that he go to some metallurgist or other person well informed on the matter, and so save time and trouble. Why did I not give the information myself? Why should I, when I took exception to his article as being of no value to the trade he is trying to enlighten? As to weighting down copes, I reiterate what I then asserted, that if the uprising is only attributable to one or all of the three causes stated by Mr. W., the difficulty of knowing the amount of weight necessary to hold them down can easily be overcome. But I fear there are other causes—causes that have not been dreamt of in Mr. West's philosophy. As for making experiments with the different heights of heads, I supposed, as he stated it, that that was his plan of solving the problem. He says any scientist would laugh at my ideas of the matter. Well, perhaps, he is right. I am only an ordinary foundry man of long and somewhat varied experience; but of this I am satisfied, if only scientists laugh at my ideas, I am perfectly safe from any great amount of merriment on the part of Mr. West.

As to the V-grooved weights, I still consider his plan inferior to the one I suggested, as, when in subsequently breaking them up, that tenth man he speaks of as not having a drop, would find himself somewhat inconvenienced.

As to my "fourth shot," as he styles it (about his cinder beds), I have only this to say: if his drawings were not what he intended them to represent, or if he wrote one thing and meant another, it is unfair to hold me responsible if I misunderstood him. His drawings showed a mould made on two cinder beds, *with his binders placed below the lower bed;* underneath his lower or slanting cinder bed he shows a bed of sand. Now, I hold that, if water enough leaks in to run through that slanting cinder bed, the sand underneath will become mud, and when he comes to bolt his cope down he will find it impossible to secure his mould properly. I did not state that he placed his binders in mud, but from his drawings it was evident that the difficulty I spoke of could occur at any time during the construction of the mould. The most reasonable explanation of his present statement is, that the great length of time between the incubation of his wonderful plan and his reply to my objections, he got matters mixed, and imagined the plan, with all its defects, to be mine, and the exposure of its uselessness to be his. During my twenty-five years in the foundry, I have never met a moulder who would not prefer a brick pit to any other means of keeping water out of a green loam or dry-sand mould.

Let Mr. West understand this: when he has anything of value to the trade to impart, let him do so, and I will be one of the first to thank him for it; but as to his theories, and speculations, and experiments, I think it would be preferable for him to keep them from the public until at least they were fully matured. This, he will perceive, will be but simply fairness to the trade.

Thank you, Mr. Editor, for your courtesy, and for the valuable information we regularly receive through the medium of the American Machinist. D. F. Treacy.

Jersey City, N. J.

Engine and Boiler Performance.

Editor American Machinist:

If a theoretically perfect steam engine requires only .66 lbs. of coal per horse power per hour, and the best practical result at present is a consumption of 2 lbs. of coal per horse power per hour, there is a direct loss of 1.34 lbs. of coal, or twice the amount wasted that is required to operate a perfect steam engine.

Only about 10 per cent. of the useful effect of good coal is used in the work that is obtained. Heat is, in reality, the force, the effect of which is applied to the piston of a steam engine, at the end of a series of transformations, from which we obtain the power.

The loss, then, must be considered as the loss of heat furnished by the combustion of a given quantity of coal. This entire loss is effected between two points, viz.: the furnace under the boiler and the exhaust opening in the cylinder. If any one wishes to place a thermometer in the steam pipe close to the boiler, and another at the exhaust opening in the cylinder, they will find but very little heat has been lost in its passage through the pipe and cylinder, and yet that is where all the useful work has been performed. The principal losses may be stated as follows:

Loss by bad firing and unburnt fuel	10 per cent.
Loss of heat by going up smoke-stack	30 " "
Loss through exhaust steam	50 " "
Heat used in work in cylinder	10 " "
Total	100 per cent.

The heat in the exhaust steam may be, and is generally, used for heating feed water, and sometimes for heating buildings or other purposes, but this is not the direction in which to look for improving the economy of the steam engine. True, the heat in the exhaust steam will heat feed water, but the heat thus saved does not affect the present revolutions of the engine, but some future revolutions get the benefit of it.

I do not think boilers have received the attention in planning and constructing that they should receive. The best practical result at present is an evaporation of 10.5 or 11 lbs. of water per lb. of coal consumed, while the average boiler will evaporate only 7 or 8 lbs. of water per lb. of coal. This loss results from causes, some of them unavoidable, but nearly all subject to modification.

Evaporation takes place only at the surface of the water in a boiler, and consequently, other things being equal, it depends on the amount of surface exposed for evaporation if we want to make steam fast, or want a large amount of water evaporated from a small amount of fuel. In all steam boilers the surface area exposed for evaporation is small compared with the amount of water contained in the boiler. The depth of the water does not help the evaporation. If the same quantity of water were put into some different shape, or even a quantity much less, we could certainly get much more steam from the fuel used than we do now.

The presence of scale in a boiler represents a large loss, and it is difficult to get rid of.

Even if softened by the use of compounds, it is seldom thoroughly removed, and when heated is again baked on the surfaces. The best way is to prevent the formation of scale, which can be readily done if the water is fresh.

STARTING BAR.

A Combination Machine.

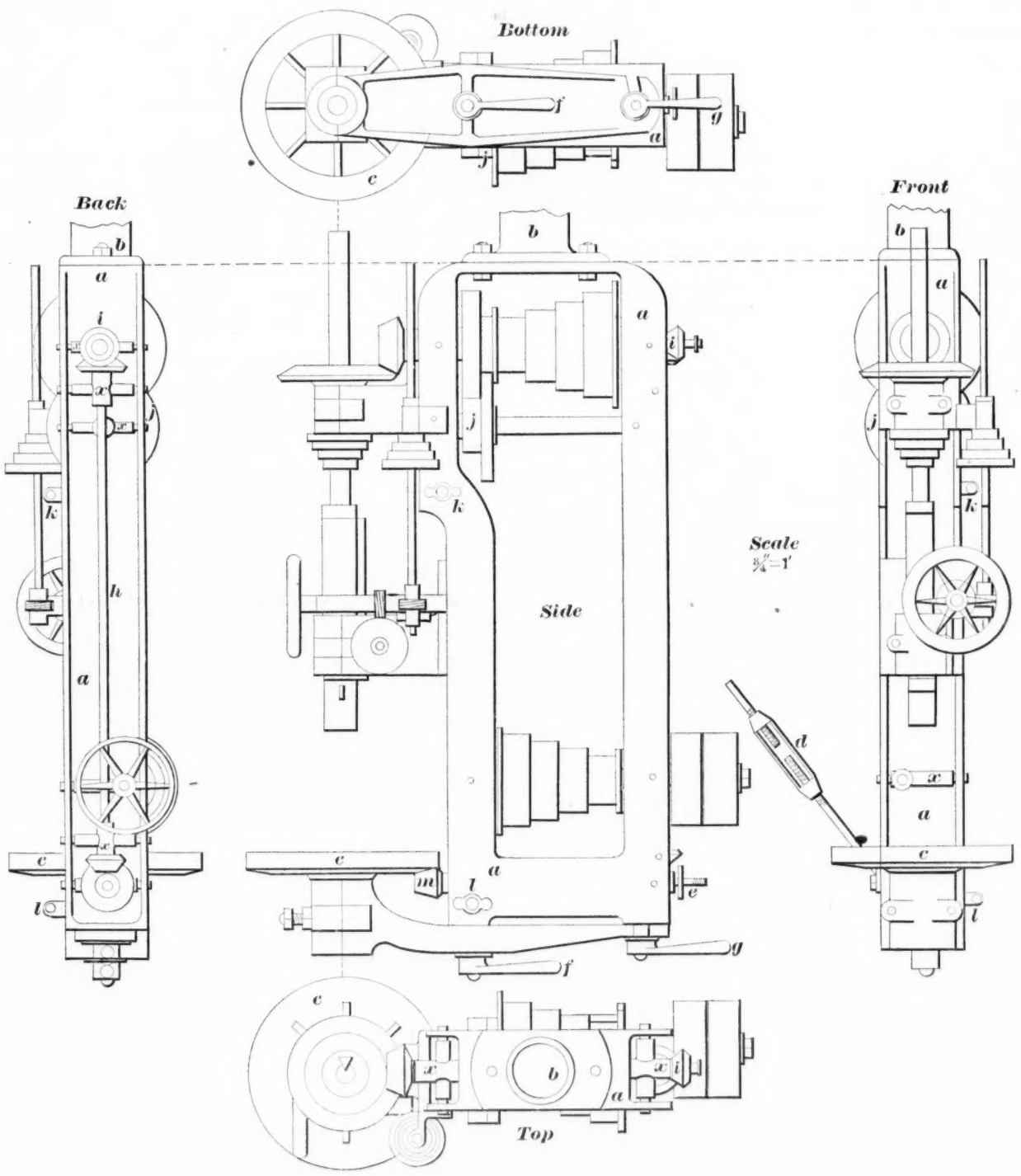
BY F. G. WOODWARD.

The present illustration represents a combined vertical drill, boring mill, turning lathe and gear cutter, designed more especially for amateur and experimental machinists. For the sake of greater convenience and more extensive application the machine is suspended, its support being entirely by the timbers overhead, thus affording a clear field upon the floor under the machine to drill such large articles as cannot be placed upon the table. To save expense the body *a* is of the box or gutter style, cast in a single piece. This style of body admits of pivot boxes *x*, being used for all of the chief journals (see top and back views).

The suspension piece, *b* is a plain cast-iron column of sufficient length to bring the table *c* about four feet above the floor, the lower end of the body being adjusted and held firmly by three or four tension rods with right and left screw links, one of which is seen at *d*. The table *c* and its carrier are held up to the body by a single bolt and handled nut *f*. A like bolt and nut *g*, secures the table laterally. By loosening these two nuts and dropping the pinion *m*, by turning the handle *l* half round, the table may be turned aside out of the way when operating upon articles on the floor.

When the machine is used for boring and turning the table *c* is driven by the shaft *h*, and a system of bevels, as clearly shown in back view, the driving bevel *i* being upon the rear end of the upper cone shaft, thus giving to the drill spindle *n* and the table *c* the same number of changes of speed. The auxiliaries *j*, are thrown in and out of gear by half a turn of the handle *k*. The shaft that carries the pinion *m* has an extension, seen at *e*, to which the usual ratchet device may be applied for the purpose of cutting gears.

By applying a cutter-head (not shown) to the front face of the body just above the table a satisfactory job of gear cutting may be executed, provided the table gear and the pinion *m* are accurately cut, and that the number of teeth in the table gear is an exact multiple of the number in the pinion. Let the table gear have 125 teeth, for instance, and the pinion 25, a proportion of 5 to 1, hence 5 is the numerator and the number of teeth desired the denominator of a fraction which expresses the amount of movement to be given to the pinion for each tooth. For example, if we would cut a gear with 23 teeth the pinion must move $\frac{5}{23}$ of a revolution for each tooth or its equivalents $\frac{10}{46}$ or $\frac{20}{92}$, hence if the ratchet contain 46 notches, 10 of them must be taken for each tooth. Or if we would divide a circle into 360° the expression is $\frac{5}{360}$ or its equal $\frac{1}{72}$, a ratchet of 72 notches and a movement of 1 notch for each division will give the desired result.



An epidemic of international exhibitions is anticipated by the New Orleans *Picayune*, and not without good reason. The people of Louisville could not wait until the Cotton Centennial next year for an enterprise similar to that which resulted in so much profit to Atlanta, and a building 910 feet long and 620 feet wide is to be opened in their city on the first of next August, with the expectation that it will be visited by more people than were at the Atlanta Exposition. New Orleans is nearly twice as big as Louisville, and her people regard their right to the Cotton Centennial of 1884 as undeniable, and they are tickled to think that the Southern Exposition to be held at Louisville this year will relieve their city of a most formidable rival for the honor. Louisville has not more than 135,000 inhabitants, but they subscribed $250,000, with some aid from neighboring cities, to ensure the success of their great summer's enterprise, and if the people of New Orleans will subscribe twice as much for the Cotton Centennial they can undoubtedly have it.—*Mail and Express.*

Our attention was directed recently in the shop of Geo. A. Gray, Jr, & Co., Cincinnati, Ohio, to a simple arrangement for increasing the capacity of an iron planer. Mr. Gray had substituted a 36 inch pulley in place of a 12-inch pulley for quick return motion, thus accomplishing the return in one-third of the usual time. The back motion is therefore very lively and somewhat noisy. He gains one quarter in the time of planing off a planer bed.

There are 149 coke establishments in the United States. The product of coke in 1880 was 2,752,475 tons.

While calling upon several Cincinnati machinery manufacturers recently, we noticed the frequent expressions, "Before the flood," and "Since the flood." These periods, however they may strike a stranger, have no reference to antediluvian times. Noah's flood, probably, did not interfere with operations in many machine shops, but the recent heavy freshets along the Ohio River stopped work for a week in a number of the largest machine shops. In Cincinnati the shops of J. A. Fay & Co., the Lane & Bodley Co and H. L. Shepard & Co. had six or seven feet of water on their first floors. Traces of the flood, however, are now few. The work of rehabilitating motive power, shop tools and offices was rapid, and everything goes on just as if no flood had happened.

In England the advisability of constructing steam fire engines separate from the boiler is strongly advocated. The principal argument in favor of such construction is reducing the weight of a single part, by which it would be easier and quicker brought to a fire; but, in the majority of instances it is questionable if this would not be offset by delays in making the connection between boiler and engine.

A correspondent writes us to say that he believes that it was a man of the name of Barber, of Norwich, Conn., who, in 1862, was the first person to turn the exhaust from a steam pump into the suction. This may aid some one who is inquiring into the matter.

We learn that Wm. Sellers & Co. and Wm. B. Bement & Son have both been experimenting for several months past upon extra rapid return planers. The results have not been made public.

For the year 1882 the exports of this country to Mexico were $15,601,028, against $11,191,238 in 1881. The most noticeable increase was in iron, steel and cotton manufactures.

It is said that recent trials on the South-western Railway of Russia show a saving of 20 per cent. of fuel in favor of a compound locomotive engine over the ordinary locomotive.

Lieutenant Rogers, U. S. N., having been ordered by the Government to pass over the line of the Panama canal, says that the work of excavating has already commenced at two points, and that the preliminary work of erecting docks, machine shops and machinery, is so far advanced that nothing is to hinder work being vigorously prosecuted as soon as the dry season begins. He says the officials are sanguine that the ship canal, which has been decided upon, will be completed in 1888. Lieutenant Rogers concludes that the canal will be completed if the funds are forthcoming, but not until some years later than the time fixed upon, and that the cost will largely exceed the estimates. Up to the present time about 130,000,000 francs have been expended.

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☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those especially interested in the occupations we represent, on subjects pertaining to machinery.*

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NEW YORK, APRIL 21, 1883.

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The Apprentice Question.

Writers and talkers on the apprentice question make a mistake when they assume that boys are no longer willing to learn trades, especially the machinist's trade. So far from this being true, boys who are willing to serve a regular apprenticeship at this trade for the bare means of living were probably never so numerous as they are to-day. If manufacturers have concluded to get along in the near future without the assistance of skilled mechanics, or to depend entirely upon the foreign supply, of course that settles the matter so far as American boys are concerned, but in justice to the boys it ought to be understood that the trouble is not all, nor mainly, on their side.

There were many things in the old apprentice system—or, rather, utter lack of system—that made its satisfactory working an impossibility. There was no properly defined obligation on either side, and hardly a general understanding of mutual responsibility. Besides, there was no consideration whatever of the fitness of things. A boy went to a trade with an undefined idea that he would like to "learn" it, rather than because he had a special fitness for it, and the result was often its early abandonment, or even worse, following a business for which he had no taste, and no chance whatever to excel or to reasonably succeed. If all this was unsatisfactory to the employer, it was no less an injustice to the apprentice, and exactly why a trial in such a way that on the simplest business principle failure was assured from the beginning should condemn the entire practice is not plain.

Unquestionably, the old plan of apprenticeship to the machine business is of the past. It cannot and ought not be revived; but the prejudice in favor of mechanics who have entitled themselves to the name is not lessened, and in the interest of all parties, and in justice to the coming boys, it is not wise to neglect provision for the future supply.

In a Western machine shop (for the particulars of which we are indebted to one of the proprietors) a rational system of apprenticeship is in operation, the results of which are entirely gratifying. In this shop the apprenticeship contemplates learning the machinist's trade—not the use of some special tool. It further contemplates the discouragement of attempts to try to learn the trade when there is no prospect of its accomplishment. The pay for the three years almost nominal, necessitating the closest economy on the part of the apprentice, the consideration being plainly what he learns, and not what he is paid for learning it. In this shop six months are devoted to trial, and if at the end of that time it is not reasonably plain that the boy will make a successful machinist, or if his liking for the business is not sufficient to induce him to continue at small pay, he is required, or permitted, to leave. If, on the contrary, the relations are mutually agreeable, he gives bonds in the sum of $200 to work two and one-half years longer for the sum fixed, and in consideration he is to be taught, and afforded the opportunity to learn, the trade. This plan does away with the objection to having those around who, with no tact nor desire in the necessary direction, are neither profitable to the shop nor derive profit themselves from their connection with it. While a pecuniary advantage to the employers, it affords them the satisfaction of helping along those to whom, on all principles of common justice, something is due. Such a course generally and rationally pursued would not only equalize the demand and supply in relation to skilled mechanics, but would favorably affect the general character of the supply in a manner that would be plainly felt in the manufacturing interests of the country. It may be noted in support of the assertion that there is no lack of the better kind of boys who are anxious to learn trades, that the applications from those entirely unexceptionable are always far in excess of the number that can be taken, fifty names of applicants being sometimes on the books.

Room for Foundry Improvement.

Economy in cost and excellence of quality of iron castings receive too little attention in many, if not most, establishments combining machine shop and foundry. A notion has prevailed in New York and New England that coke is too expensive for foundry fuel, but several who have tried it within the last few months report a decided advantage over anthracite coal. Coke is a common foundry fuel in certain parts of the West, and good castings are made where it is used. First-class machinery castings are produced in Cleveland, and some other cities, at $2\frac{3}{4}$ to 3 cents a pound. In Chicago, and in some localities in the East, the same kind of castings sell one cent a pound higher. One of the best-known New England machinery manufacturers, owning a good foundry, ordered a lot of castings from Cleveland a few months ago. Upon working them up the results were so satisfactory that they commenced using coke and changed their mixture of pig, charging the cupolas in part with iron from Ohio furnaces. The change has proved to be a decided advantage. A large Chicago machinery establishment has, we learn, made a contract to be supplied with castings by a Cleveland foundry. Not long ago a large order was placed in France for iron castings by a New York State concern. It was claimed that the price, after paying duty, was lower than the castings would cost if made near home. These incidents are highly suggestive to foundry owners and managers.

A Desirable Endowment.

While some of our railroad or other financial magnates are about it, there are several who might seriously consider the advisability of presenting the American Society of Mechanical Engineers with a building and library worthy of the objects to attain which the society was formed. If desired, probably the two older engineering societies (Civil and Mining) would not object to sharing in such a benefaction. To bring these three great institutions under one roof, forming a grand engineering headquarters, while enabling each to preserve its own individuality, would be something that any man, though a railway millionaire, might be proud to accomplish. To be an "endowment member" of these great organizations, by virtue of such a gift, would lay a sure foundation for a noble fame. Especially would it be a graceful act, if done, for the reason that it would fitly acknowledge the obligations of the giver, as a successful railway man, to the three great departments of civil, mining and mechanical engineering.

The town of Vassalboro, Me., at its recent election, voted to exempt from taxation for ten years all investments in factories of any sort, where $5,000 is expended. It will probably be a mooted question, in a few years, as to what class of Vassals shall pay the taxes. Then, after the town has been heavily bonded to pay for "internal improvements," and the ten-year period expires with the manufactories that have been induced to locate in that boro, the question will probably arise as to how heavy a tax those erstwhile exempted industries can stand when the bondholders must be paid. It is not improbable that, in the future, dissenters may rise up and declare that it would have been better for both manufacturers and miscellaneous property-holders to have aided each new productive industry by voluntary subscriptions of the citizens. The tax-exemption plan has produced results in some localities such as we have indicated, but Vassalboro may make it work successfully.

In a recent issue we called attention to "A Needed Sanitary Shop Rule," and advised the procuring of mica masks with air-filtering devices for workmen who run emery wheels, and the making it obligatory for the workmen to wear them. Since that issue went out we have received a number of inquiries from proprietors of manufacturing establishments as to where such masks can be procured. We are obliged to answer that we do not know. Probably there has been no demand for them. Now is a good time to start the manufacture of mica masks, as proprietors are inclined to *require* workmen to observe precautionary measures to protect life and health. We confidently believe that such an industry would abundantly pay its promoters. The columns of the AMERICAN MACHINIST are open to receive notes of the origin and progress of an enterprise of this kind.

Literary Notes.

THE TEMPLET ODONTOGRAPH, An Instrument for Describing Teeth of Gear Wheels. The Practical "Short-Cut" for Millwrights, Machinists and Pattern Makers. By Prof. S. W. Robinson, Columbus, O.

This new edition of Prof. Robinson's new pamphlet, intended to accompany his Odontograph for laying out the curves of gear teeth, clears up many of the more intricate problems associated with the laying out of gear teeth. Rules and tables are given for rapid approximation, and for application to all ordinary forms of teeth. A slip containing tables most used accompanies the book, and may be pasted into the lid of the instrument case. This instrument is simply a templet odontograph or pattern of the right shape for marking out the teeth, and can be used without long and intricate calculations. In addition to the numerous rules and tables this book is plainly illustrated.

The *Sewing Machine News* for April contains a two or three column description of the new shops of the Home Sewing Machine Co., of Orange, Mass.; also "Shop Kinks," descriptions of sewing machine devices, and a variety of trade notes. It is published by Chas. W. Handy, 31 Union Square, New York.

We have received a neatly bound volume (Vol. 6) of the *Sanitary Engineer*, including the twenty-seven issues from June 1 to November 1, 1882. The contents of this well known and widely circulated journal possesses much more than transient interest. Its articles are from the pens of the most eminent writers of the day on sanitary matters, and can be relied upon; while a large part of the literature on public health, ventilation, &c., palmed off upon the public as the opinions of experts, is merely speculation and unworthy of serious attention.

In the volume before us are illustrated descriptions of the plumbing work in the well-known residences of Wm. K. Vanderbilt, Cornelius Vanderbilt, Samuel J. Tilden, John Sloane; also the "Mills Building" (the largest office building in New York) and Minot, Hooper & Co.'s Commercial Buildings, a Russian Bath establishment in Boston and the St. James Hotel in Baltimore. An elaborate illustrated report of the Berlin sewerage system by an eminent French authority, claims special attention. The engineer in charge of the sewerage system of Pullman, Ill., also contributes a paper describing it.

Among the great number of articles the following should be widely read:

"Tin in Canned Fruits," by Prof. Albert B. Prescott.

"Letters to a Young Architect on Heating and Ventilation," by Dr. J. S. Billings, Surgeon, U. S. A.

"Burning of Town Refuse at Leeds," a paper by Charles Slagg, Assistant C. E.

"The Relative Uses of Gas and Electricity," by C. Wm. Siemens, F. R. S.

"Heat, House Plumbing and Mortality," by Lewis M. Leeds.

"The Management of Heating Apparatus," by Edward S. Philbrick, C. E.

Practical articles on "Steam Fitting and Steam Heating," by "Thermus."

"The Effect of Water Level on Disease," by Baldwin Latham, M. Inst., C. E.

"Lead Poisoning," by Dr. Edw. S. Wood, Harvard Medical College.

In addition to the regular articles there are answers to a great variety of questions,

editorials, record of new patents and reviews of gas and electric light industries. The price of the volume is $3, and postage 40 cts. The office of the *Sanitary Engineer* is 140 William street, New York.

Questions & Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(148) J. J. M., San Francisco, Cal., asks for directions for charging a 30" cupola to melt iron with charcoal. If some of our readers who have had experience in melting with charcoal will give us the details of charging and melting, we shall be glad to publish them for the benefit of others.

(149) J. C. C., Ithaca, N. Y., asks: 1. Can brass castings be made as sound, using old brass, as they can be made from new metal? *A.*—Sound castings can be made from old metal, but it is customary to mix the old metal with new in making castings. 2. What is used as a flux? *A.*—Sal-enixum is sometimes used where considerable quantities of copper are to be melted.

(150) Apprentice, New Orleans, La., asks: Is steam generated as rapidly in a boiler when the water is kept high as when it is kept as low as is consistent with safety? *A.*—This depends upon the construction of the boiler and many other circumstances. The only way to determine in any particular case is by trial. Carry the water where it requires the least amount of coal to do the work, of course always carrying it high enough for safety.

(151) J. S. B., Montreal, P. Q., asks: How shall I bore a wrought tube 12" diameter and 12 feet long, the bore to be 6" with round bottom, the hole not extending through the tube? *A.*—Use a tool similar to the one shown in American Machinist, of Aug. 13, 1881. For shaping the bottom use a step-reamer first, and afterwards a round end finishing reamer.

(152) A. M. R., Wanganui, New Zealand, asks: 1. Why are steel tires after being worn flat by sliding on the rail, sometimes extremely hard and sometimes quite soft? *A.*—It is probably owing to some difference in the steel. 2. If a brake is put on hard enough to slide the wheel on the rail will it be more effective in stopping a train than if applied nearly but not quite hard enough to slide the wheel? *A.*—Not so effective.

(153) G. C., Peekskill, N. Y., writes: I have charge of a tubular boiler 4 feet diameter and 14 feet long. The boiler is made of 3/8" iron and is in good condition with no scale worth mentioning. On the first sheet over the furnace the iron has flaked off a place as large as the palm of a man's hand apparently to a depth of about 3-32". Will it be safe to continue to use the boiler under a pressure of 60 lbs? *A.*—We should advise that you have the boiler examined at once by a competent boiler maker.

(154) W. A. P., Brooklyn, N. Y., asks: 1. Will you give me the composition of Babbitt metal, and the way to prepare it? *A.*—The original Babbitt metal was prepared by melting 4 lbs. copper, then adding by degrees 12 lbs. banca tin, and 8 lbs. regulus of antimony, then 12 lbs. more of tin. This is the hardening metal. One pound of this metal is melted with 2 lbs. of tin, which makes the lining metal. 2. Will you give me a good mixture of bronze for lamps and ornamental work? *A.*—An alloy sometimes used is made of copper 82 parts, zinc 18 parts, tin 3 parts, lead 3 parts. The proportions are varied almost infinitely, to suit the conditions as to cost, &c.

(155) W. H., Glens Falls, N. Y., asks: 1. I am building a marine engine 10½"×12" to work at about 100 lbs. steam pressure. What diameter and pitch of screw shall I use for speed? *A.*—You neglect to give dimensions of boat. Such an engine should handle a three-bladed screw 4½ ft. diameter and 6 feet pitch, if the boat is suitable for it. 2. What inclination shall I give the shaft? *A.*—Give it an inclination that will best suit the construction of boat and machinery. 3. What will stick labels to tin? *A.*—It is said that a drop or two of glycerine added to a small bottle of mucilage makes a good cement for this purpose.

(156) W. E. R., Arlington, Mass., writes: We have a horizontal return tubular boiler, 48" diameter, with 49 tubes, 16 feet long; 20 sq. ft. grate surface. The grates are 29" below the boiler. The boiler is set with a curved arch 6" from boiler. Beyond the bridge wall the surface is level with the grate, and slants up to within 12" of boiler at back end. The walls are double, with air space, and the outside walls are carried up, and the top of boiler covered with coal ashes. The chimney is 60 feet high, with good draught. The tubes fill up with mud (?), and it is necessary to clean them out often. We have an engine 12"×24", running 100 revolutions per minute. It is a slide valve engine, with adjustable cut-off valves on the back. We are doing about 25-horse power work, and burning 1,000 or 1,200 lbs. of coal per day. We have run the engine some, cutting off at 5", but it pounds and heats. 1. Why should the engine heat and pound cutting off short? *A.*—If in good condition, it should run cool and still cutting off at 5", we should advise that you apply an indicator to the engine, which will probably reveal the cause. In cutting off short, the initial pressure will be higher, and consequently the pressure on the journals greater. You will probably run just as economically following further. 2. Why do the tubes stop up? *A.*—It is probably the result of slow combustion in the furnace. If you were burning twice as much coal, you would not have this trouble. 3. Are not the tubes too long for their diameter? *A.*—Assuming the tubes to be 3" diameter, they are rather long. 4. What is there wrong about the boiler setting? *A.*—It would appear that your boiler is very well set, and, considering the small amount of work you are doing and the size of your engine and boiler, 4 lbs. of coal per horse-power per hour is a very good result indeed.

Business Specials.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Portable Forges, $10. Holt M'f'g Co., Cleveland, O.

James W. See, Consulting Engineer, Hamilton, O.

In stock.—16" speed lathes of superior design, from new patterns.—Fay & Scott, Dexter, Me.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Mechanical Engineer. Complete motive power outfits a specialty. Peter Banta, Cold Spring, N. Y.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Machine designing and general engineering work, T. J. Winans, 54 M. & E. R. R. Av., Newark, N. J.

Currier & Snyder's Improved Upright Drill. Send for cut and price. Worcester, Mass.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

For sale, 25" lathes of best designs from new patterns. George A. Ohl & Co., E. Newark, N. J.

Chas. T. Porter, Mechanical Engineer, Tribune Building, (Room 42,) New York City.

Consulting Engineer and Mechanical expert, C. C. Hill, Room 8, Ulich Block, Chicago, Ill.

For a strictly first-class automatic engine of from ten to sixty horse-power, address, The Straight Line Engine Co., Syracuse, N. Y.

Send description and prices of 14x20 and 16x24 Engines, and 5x12, 14x16 Tubular Boilers, to Newell, Sanders & Co., Chattanooga, Tenn.

H. E. Penney, manufacturer of Steel Spring Cushioned Helve Hammers. Photo and circular on application. Minneapolis, Minn.

New tool chest, price $10.00. See description in American Machinist, April 14th, or send for circular. Goodnow & Wightman, 176 Washington st., Boston, Mass.

W. H. Warren, Worcester, Mass., is adding several new features to his improved Radial Drill, and is very busy filling orders for them.

Boiler Scale.—Parties having fine specimens for sale or loan, for exhibition, address Jas. F. Hotchkiss, 84 John street, New York.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant. $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

A handsome monthly journal sent free to engineers and mechanics. Enclose twelve 6-cent stamps for year's postage and receive paper. Money Saver, 95 Liberty street, N. Y.

"Patent Binder" for the American Machinist holds 52 weekly issues in good shape. Sent to any address by mail for one dollar. American Machinist Publishing Co., 96 Fulton street, New York.

Free—"Useful Hints on Steam." A book of 96 pages, illustrated. Valuable to engineers, steam users and those about purchasing steam machinery By mail, 15 cents, or free on personal application. E. E. Roberts, 107 Liberty St., New York City.

Wanted—Correspondence with engine builders, boiler makers, and supply dealers in steam goods. We manufacture the *cheapest* Injectors and best Steam Jet Pumps in this country, and offer to *live men* the most liberal terms ever named. Drop postal for particulars to J. B. Sheriff, Son & Co., 68 Water St., Pittsburg, Pa.

Now ready for delivery, volume 5 of the American Machinist, comprising the year 1882, (52 issues) complete with index, in substantial book form Also a few remaining of volumes 3 and 4 comprising the years 1880 and 1881, can be sent anywhere by express. Price of each volume, $4.00; express charges to follow. American Machinist Publishing Company, 96 Fulton street, New York City.

Chordal's Letters.—John Wiley & Sons, 15 Astor Place, New York, have now ready a new and enlarged edition, with six additional plates, of Chordal's Letters, comprising the choicest selections from the series of articles entitled "Extracts from Chordal's Letters," which have appeared in the columns of the American Machinist; with a steel portrait of the author, and upwards of fifty original illustrations by Chas. J. Taylor. One volume 12 mo. of nearly 400 pages, cloth, $2.00. Will be mailed and prepaid on the receipt of the price.

Manufactures.

Gravel has been broken for a new blast furnace at Cranberry, N. C.

The A. Burritt Hardware Company, Waterbury, Conn., are about to build a malleable iron foundry 50x200 feet.

The Burlington Woolen Company of Burlington, Vt., is to erect a new mill of large dimensions the coming season.

Articles incorporating the Evansville (Wis.) Manufacturing Company, with a capital of $25,000, have been filed. The object is the manufacture of tacks and small nails.

The Lake Shore Tube Works, W. L. Hurd, general manager, and John J. Fisher, superintendent, will begin operations in the course of a week or ten days.—*Cleveland Trade Review.*

Prof. Chas. I. King, Madison, Wis., is about starting a manufacturing enterprise in that city. New buildings have been erected for the purpose, and machinery is soon to be put in.

The Ryse Mfg. Co., Indianapolis, Ind., are putting the machinery into their new shop to manufacture drop forgings, pipe wrenches, pipe stocks and dies. They will be under way in about a week.

Ground has been broken for the building of the new model stove foundry of Duffy, Trowbridge & Co., Quincy, Ill. The firm will consist of James Duffy, Chas. H. Trowbridge and James A. Duffy.

The Cleveland (O.) Twist Drill Company write us: We hear many complain about slack times, but we are crowded to death with orders, and don't feel the new machinery added recently, and are about to add still more.

The Metropolitan Stove Company will locate their new works at Ashtabula, Ohio, the citizens having contributed a site and raised $600 towards starting the works. From 100 to 300 men will be employed.

Manning, Maxwell & Moore, 111 Liberty street, New York, railway and machinists' supplies and proprietors of the Ashcroft Manufacturing Company and the Consolidated Safety Valve Company will make a large display at the Chicago Railway Exposition.

The McTighe Electric Light and Manufacturing Company, capital $300,000, will erect a large manufactory in Pittsburgh, Pa. Among the incorporaters are F. B. Laughlin, of Jones & Laughlin, Wm. N. Riddle, of the Penn. Bank, Matthew McMullen, J. M. Patterson and Thomas J. McTighe.

The Compressed Paper Box Company (Godfrey & House) Bridgeport, Conn., have taken contract from the Union Metallic Cartridge Company, for forty thousand paper boxes a day. They have put up a three story building, and will occupy it shortly. They make a paper box without cutting the stock, by pressing it.

The Brooklyn (N. Y.) City Railroad Company, a large and wealthy corporation, has decided to abandon their old repair shops, which were too small, and to fit up new shops, using the buildings formerly occupied as car stables. The work of altering the building is soon to be commenced. They have erected a new structure for stables said to be the most magnificent building of its kind in the United States.

The San Francisco (Cal.) Tool Company are about to commence building a new shop of brick, three stories, to contain 18,000 feet of working floor and office room, and 7,500 feet of storing room. The works will be driven by a peculiar engine of the compound type to be made by the company. The works are full of orders with good prospects for future trade.

Lodge, Barker & Co., Cincinnati, Ohio, machine tool builders, are well supplied with orders, and are cramped for room. They will build this spring a new shop 46×100 or 125 feet with four floors. to accommodate their extending business. Last year they sold $17,000 worth of lathes to go East, and their customers are pretty well distributed both East, West and South.

The New York West Shore & Buffalo Railroad Company has decided to locate its principal locomotive and repair shops at Frankfort, Herkimer County, N. Y., nine miles east of Utica. The citizens of Frankfort, Ilion, and Utica clubbed together and raised funds to purchase 140 acres of land for a site. This they gave to the company free from all incumbrance. It cost about $75,000. There is great rejoicing among the citizens of those towns at the success of their efforts.

According to a late issue of the St. Louis *Age of Steel* the machine shops and foundries of that city are quite busy. The Standard Foundry Company report a perfect rush of orders, and will soon occupy their new buildings. The Missouri Pacific Railway shops are running full handed. The Union Machine shops are running full time and force, with three months' orders ahead. The Whitman Agricultural Company report an excellent trade in their specialties, and the Phoenix Boiler and Sheet Iron Works are as busy as the proverbial bee on a good supply of orders.

Gunnison, Colo., has been selected as the site for the erection of iron and steel works. The company has been organized in St. Louis some weeks, and has a capital of $5,000,000. The promoters or the scheme are B. W. Lewis and J. H. Harrison, of St. Louis, and J. M. Schoonmaker, of Pittsburgh, together with the leading officers of the Union Pacific Railroad, and other wealthy capitalists of New York, Boston, Pittsburgh, Philadelphia and St. Louis.—*Engineering and Mining Journal.*

Mr. F. Farrel and other gentlemen interested in the Farrel Foundry and Machine Company of Ansonia and Waterbury, in conjunction with parties from Vermont are erecting a large building at Bridgeport, Conn., for the forging of large shafts, &c. The shop is about ⅛ mile south of Sharp's Armory, located there to obtain a water front at a fair price. A track is being put down connecting with the New Haven Railroad. We understand they expect to turn out as large forgings as can be made in this country.

The Westinghouse Steam Engine Company, Pittsburgh, Pa., and New York City, together with the Westinghouse Air-Brake Company, and the Union Switch and Signal Company (all owned virtually by the same parties) will have the largest space at the Chicago Railway Exposition. It will be fully one half larger than the whole machinery hall of the American Institute Fair. A line of engines will be shown from 14" diameter of cylinder, down to 4" diameter, varying by one inch. The exhibit will include the first Westinghouse engine ever built, 3"×2". They will also light a portion of the building by a 7"×5" engine driving a Brush dynamo 800 revolutions per minute.

While calling at the works of the Lane & Bodley Co. in Cincinnati, Ohio, recently, we found Col. Lane and some of his assistants in the drawing room poring over the plans of a new portable engine boiler of the Cornish type. The boiler will be 10½ ft long and 50" diameter. A 30" flue well stayed is placed so as to leave just 2" from the bottom to the shell of the boiler. There are eleven stays to fasten the flue. The return tubes are 8". A large steam space is provided so as to prevent priming. Two rings are set in at the bottom of furnace to admit air. The company employs 350 workmen, and is making an addition to the shops, which when completed will enable them to employ 425 men. Some very heavy tools are to be placed in the addition.

The Niles Tool Works, Hamilton, Ohio, are selling their heavy machine tools not only to all sections of the United States, but largely to Europe. They have for months past been running 22 hours out of 24 every working day. Two sets of hands are employed, one set working from 7 A. M. to 6. P. M. (with an hour intermission) and the other set from 6 P. M. to 7 A. M. They are extending their shops constantly to make room for more tools. In going through their shops recently we noticed in course of construction a 16 foot boring mill, which when completed will weigh 75 tons. It is building for the Dickson Mfg. Co., Scranton, Pa. Another large boring mill was building for L. Sterne & Co., Limited, Manchester, England. The bed was being finished for a planer 60"×60"×25 feet. It will weigh 56,000 lbs. when completed. It is worthy of note that some of the smoothest and soundest large iron castings produced, in the West are turned out of the Niles Work's foundry.

The Lancaster Manufacturing Co., 95 Liberty st., New York, has been organized under the laws of the State of New York, with a capital stock of $250,000. The facilities for manufacturing the "Lancaster" tools will now be very considerably increased, and every effort made to execute orders more promptly than heretofore. The officers of this company are, James H. Lancaster, President; John Pickering, Treasurer; John Q. Maynard, Secretary The company has acquired the sole rights to manufacture and sell in the United States and Canada the patented inventions of J. H. Lancaster, consisting of stocks, dies and adjustable pipe guides, twin pipe cutters with burr scrapers, combined pipe and nut wrench, combined pipe cutter, wrench and burr scraper, combined punch, shears, wire cutter and anvil, and pipe inside burr reamers, and other improved tools will be added to this list from time to time.

We called upon J. A. Fay & Co., Cincinnati, Ohio, a week or two ago, and found plenty of evidences of a very lively business in making and selling wood working machinery. "Here," said Mr. Doane, president of the company, "is one order by mail this morning for seventeen machines of different kinds amounting to $5,000, and last week we had one order by telegraph for sixty machines, all to go out of the country." In looking through the shop we noticed several machines building for foreign countries, and saw several boxed and marked "Melbourne, Australia," going out the door for shipment. They employ 300 men, and by aid of economical arrangements claim that as much work is turned out as with 700 men in ordinary machine shops. They sold Pullman alone $20,000 worth of machinery last year. Most of the large shipbuilders on the Clyde and on the Tyne send to J. A. Fay & Co. for their wood working machinery. Two years ago when one of those large shipbuilding works burned, Fay & Co. received a telegram for a complete outfit of wood-working tools as soon as they could be made. They will make a large and well assorted display of machinery at the Chicago Railway Exposition. Mr. Doane says "We will show a line of machinery that will make Eastern woodworking machinery manufacturers sick."

Machinists' and Engineers' Supplies.

NEW YORK, April 5, 1883.

The feeling is good, and all continue to hope that with settled weather business will proportionally increase. Some of the smaller dealers complain of dull times, but all of the leading houses are quite busy. Prices are firm, and have probably reached hard pan.

Business in Pig Iron has increased somewhat during the week, but the orders were for material to be used immediately. Prices are quoted as follows:

Foundry, No. 1, $23.50 to $24. Foundry, No. 2, $21.50 to $22.50. Grey Forge, $18 to $19.

Foreign Iron continues quiet with prices unchanged.

Copper continues weak at 16c. to 16¼c. Banca Tin 22c. Straits Malacca, Billiton and Australian, 21¼c. to 21⅜c. English Lamb and Flag, 22¼c. English Refined 22¾c. Spelter, Common Domestic, 4.70c. to 4.75c. Refined, 8c. to 8¼c. Lead, 4½c. Refined, 4.60c. Antimony, Hallett's, 9¾c. to 9⅞c. Cookson's 10¾c. to 10⅞c.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

A mechanical engineer, now superintendent, desires a position as draughtsman, superintendent or manager. Address, M., AMERICAN MACHINIST office.

A mechanical engineer, thoroughly competent to erect and start a "wire mill," desires an engagement. Address "Steel Wire," care AM. MACHINIST.

An experienced mechanical draughtsman wants a position in or near New York City. Address, "Active," AMERICAN MACHINIST.

Wanted—Situation as superintendent or engineer by a man of many years' experience, now filling similar position. Address, Superintendent, care AMERICAN MACHINIST.

Wanted—Position as foreman by competent machinist. Manufacture of specialties preferred. No objections to country. Address, H., care T. Burchall, 117 North Morrow St., Wilmington, Del.

Wanted—A machinist fully competent to build steam engines and general machinery. Must be a strictly sober man. Give age, references, etc. Address, Salem Iron Works, Salem, N. C.

Wanted—A superintendent for machine works in a Western city. Must be well up in all departments; a good draughtsman and designer; have good executive ability, and a thorough knowledge of automatic cut-off steam engines. Address, F, AMERICAN MACHINIST office.

Wanted—By one of the best established machinery and supply houses in New York City, a man as mechanical engineer and salesman. Must be a practical millwright and draughtsman, posted on steam engines and appliances, machine tools, &c. One lacking any of these qualifications will not answer. Address, with reference as to character, habits and qualification, X, care AMERICAN MACHINIST.

Light and fine interchangeable machinery to order. Foot and power lathes; slide rests, &c. Catalogue for stamp. Edwd O. Chase, Newark, N. J.

Ten patents of recent date to let; on royalty or shopright, belonging to saw mill machinery; all practically tested. They constitute and make the best mill in the country. Address, H., this office.

A large manufacturing corporation, exceptionally favored in its location at tide water, in successful operation for over forty years, is desirous of increasing its business by taking up specialties of established utility and merit, in either wood, iron or composition, light or heavy work. Correspondence solicited from parties interested. All communications treated confidentially. Address, A., care AM. MACHINIST.

FOR SALE.

We have the following second-hand Machinery for sale, viz.:

One Iron Planer, to plane 24 feet long, 62 in. x 62 in. square. It is powerfully geared, heavy and in good order.

One Planer to plane 15 ft. long 51" wide very good.

One Iron Planer, to plane 12 feet long, 36 in. x 32 in. in fair condition.

One Iron Planer, to plane 12 feet long, 30 in. x 30 in.

One Pit Lathe, face plate 6 feet dia., with internal wheel full dia., external wheel 38 in. dia., quadruple geared, will turn 10 feet dia. and 22 in. face in pit, swing 60 in. over ways, 48 in. over carriage, 21 ft. 6 in. between centers. All complete.

One Engine Lathe, will take 14 feet between centers, and swing 53 in over ways, has hollow spindle, and is adapted for both turning and boring, with countershaft. Complete.

One Engine Lathe, will take in 11 feet, 6 inches between centers, swings 48 inches over shears, and 32 inches over carriage. It has internal gear, and cross-feed, with countershaft. All complete.

One Slotting Machine, 12 in. stroke, slots to the center of 46 in. Adjustable table and universal feed motion.

One Combined Power Punch and Shears, to punch ⅝ and ½, and shear ½ in. iron.

One Axle Lathe, Fitchburgh Machine Co.

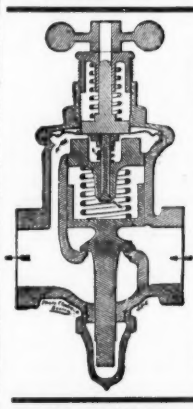
One 13 in. Shaper, Lowell Machine Shop.

One No. 1 Brown & Sharp Screw Machine.

Two 4 in Spindle Drills.

One Pond's double Miller.

The George Place Machinery Co.,
121 CHAMBERS AND 103 READE STREETS, NEW YORK.



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For Steam, Water and Air,
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GENERAL AGENCIES:
109 Liberty St., New York.
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COOKE & CO., DEALER IN
Machinery & Supplies,
12 CORTLANDT ST.,
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AGENTS FOR THE
Greenfield Vertical Engines
2½ to 30 Horse Power.
Unequaled in workmanship and quality of material. Prices lower than any other first-class engine.
ALSO
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For Machinists, Railways, Mills, Mines, &c.

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Steam & Drop Pile Drivers.

Skinner's Patent Steam Pile Hammer, automatic; very effective; simple and durable, with recent improvements.

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Blowers and Exhausters
OF EVERY DESCRIPTION.

BOOKS
—RELATING TO—
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DESCRIPTIVE CATALOGUE, 100 PAGES, 1883, SENT FREE ON APPLICATION.
E. & F. N. SPON, 44 Murray St., N. Y.

Buffalo Cupola & Forge Blowers.

Warranted superior to any other make.

All sizes and styles for every class of work.

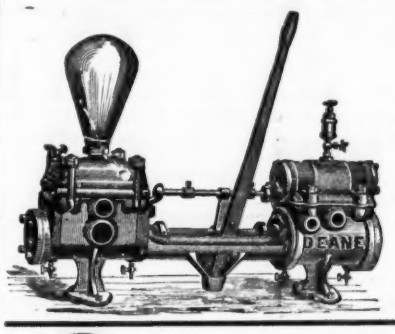
BUFFALO FORGE CO.
BUFFALO, N.Y.

Send for Catalogue and prices.

FOR SALE.

One Iron Planer. Planes 42 inches x 12 feet. Built by New York Steam Engine Co., 1873.

E. P. BULLARD, 14 Dey Street, New York



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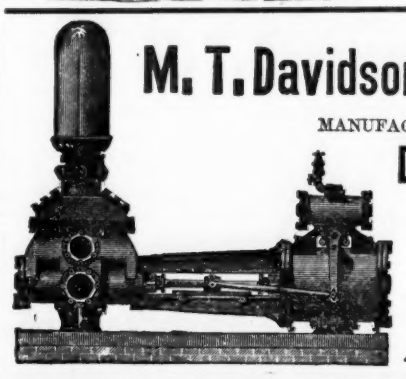

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Warranted the Best Pump made for all Situations.
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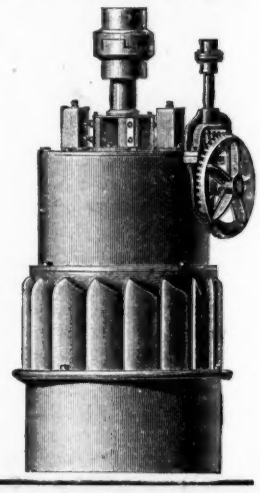
THE HERCULES TURBINE

Gives more power for the same size, also better average results from full to one-half gate than any other water wheel ever made. It is moderate in cost, compact in form, and not liable to get out of order.



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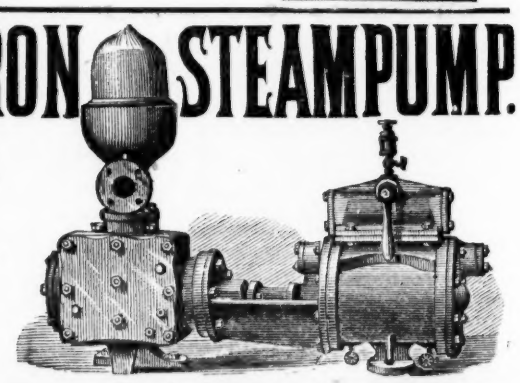
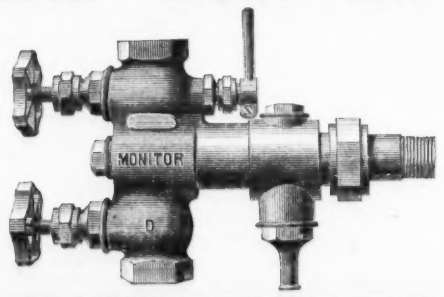
Is the Standard of Excellence
AT HOME AND ABROAD.
THE A. S. CAMERON
STEAM PUMP WORKS,
Foot of East 23d Street, New York.



THE "MONITOR."



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BEST BOILER FEEDERS IN THE WORLD.

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For Conveying Water and Liquids.
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92 and 94 Liberty Street,
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Send for Illustrated Catalogue.

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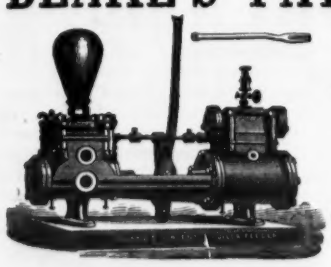

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MANUFACTURERS OF
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Of all descriptions, and of a great number of sizes; including also,
STEAM HAMMERS,
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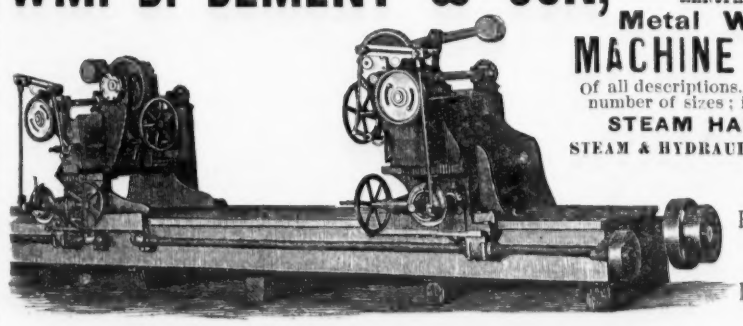

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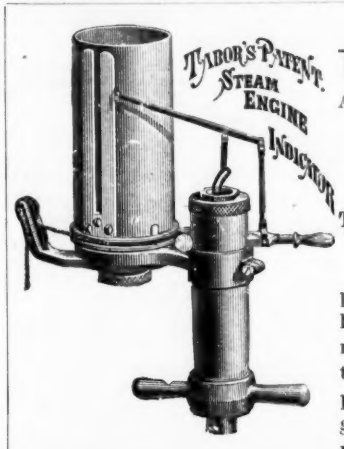

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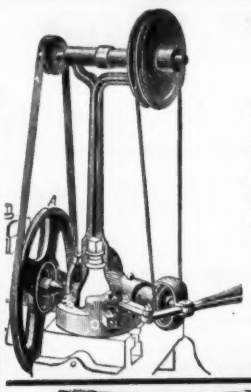
You ask me "How I am pleased with my pair of Tabor Indicators." In reply would say that I have *tested* and *inspected* them *thoroughly*, and am now more than pleased with them. The workmanship is the *best* I ever saw. I consider the instruments about perfect. You certainly have given the Indicators a great deal of attention, to bring it to such a state of perfection. Yours very truly, CHAS. A. BAUER.



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Simple, quickly adjusted to any lathe, and does its work perfectly.

Price complete, with emery wheel, boxed, $15.

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With Steel Screws. Lathe Made and Hardened.

This dog is very heavy, and is warranted not to break with any work

No. 1	3-8 in.		$ .50
" 2	1-2 "		.60
" 3	5-8 "		.70
" 4	3-4 "		.70
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" 7	1 1-8 "		.95
" 8	1 1-4 "		.95
" 9	1 3-8 "		1.10
" 10	1 1-2 "		1.10
" 11	1 3-4 "		1.25
" 12	2 "		1.40
" 13	2 1-4 "		1.60
" 14	2 1-2 "		1.60
" 15	3 "		1.80
" 16	3 1-2 "		2.00
" 17	4 "		2.30
" 18	4 1-2 "		3.00
" 19	5 "		3.50
Full set, 19 Dogs,			26.35
No. 20	5 1-2 in.		4.25
" 21	6 "		5.00

When ordering, state as above, whether a full set or a set of 12, or smallest of 8. Users of these dogs prefer them to any other make.

No 1	3 8 in.		$ .50
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" 8	1 1-4 "		.95
" 10	1 1-2 "		1.10
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Small set of 8 dogs from 3-8 to 2 ins., $7.30.

No. 14	2 1-2 in.		$1.60
"	15	3 "	1.80
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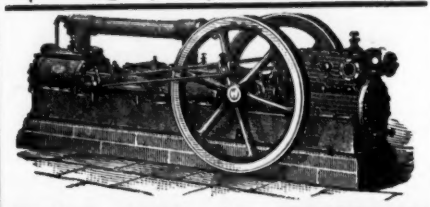
"	17	4 "	2.30

Set of 12 from 2 to 4 inches, $15.00.



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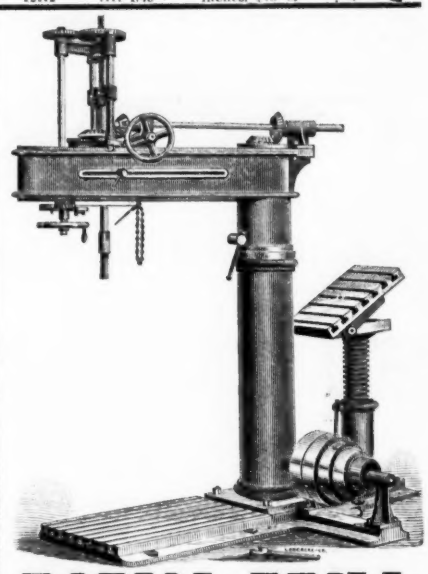

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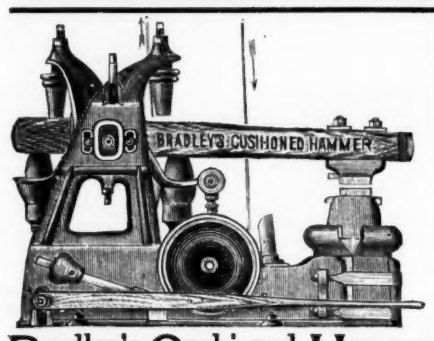

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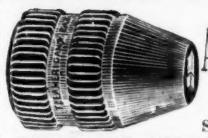

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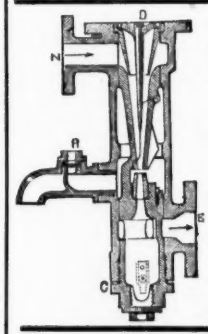

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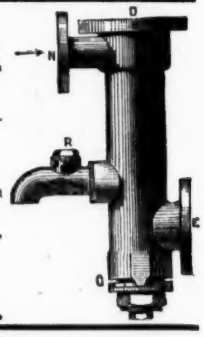

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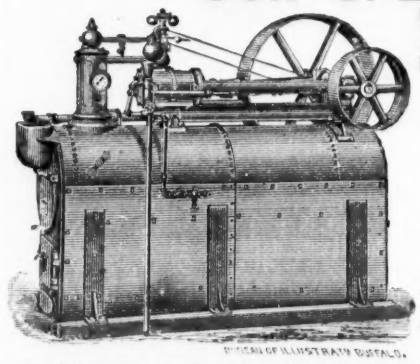

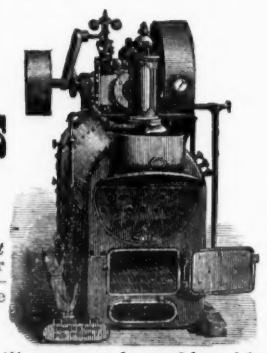

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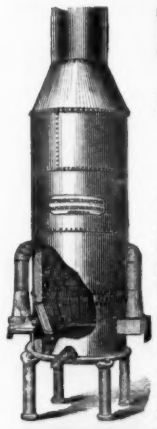

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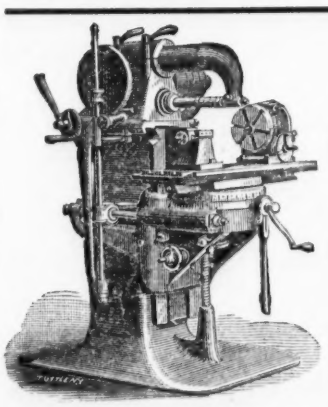

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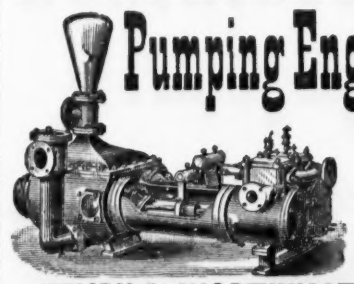

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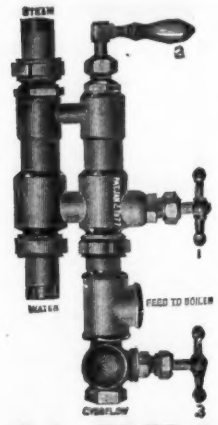

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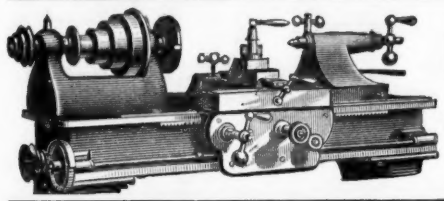

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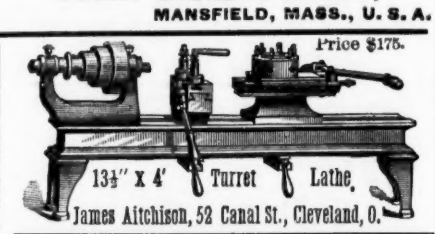

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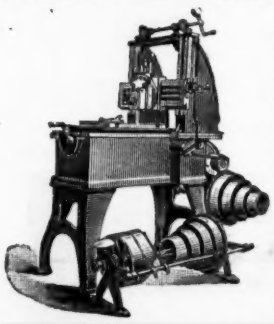

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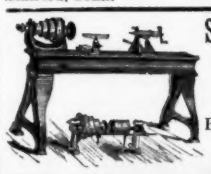

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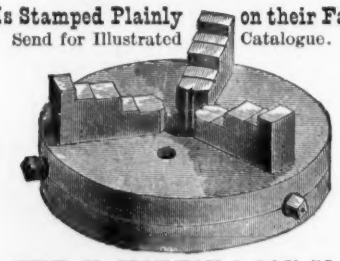

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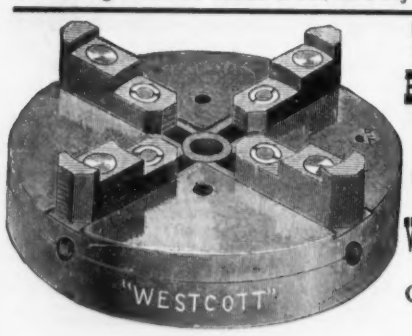

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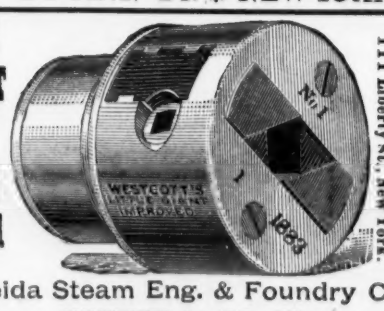

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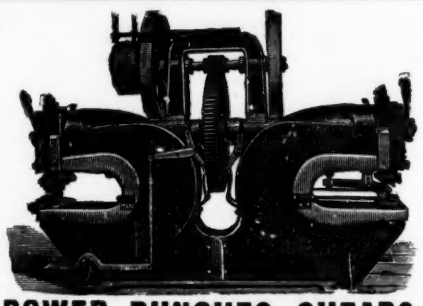

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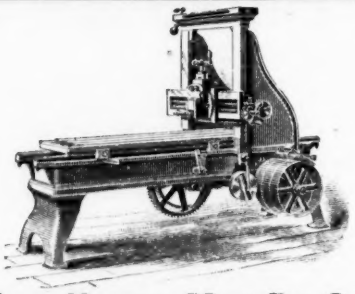

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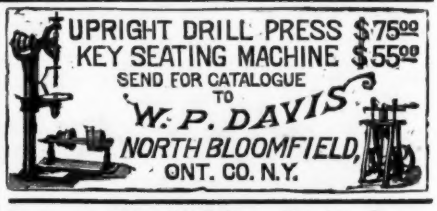

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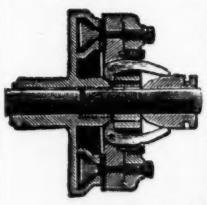

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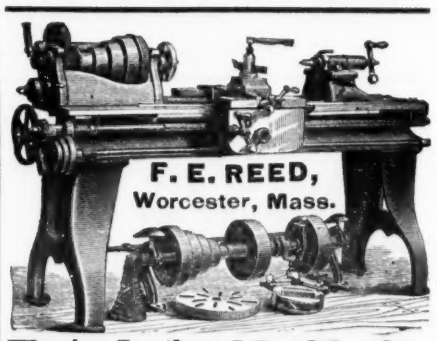

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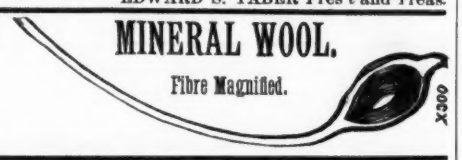

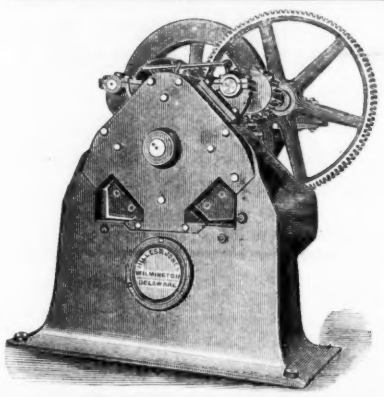

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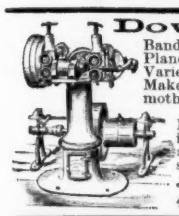

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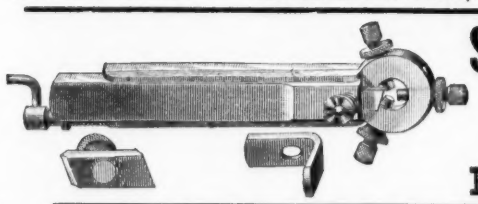

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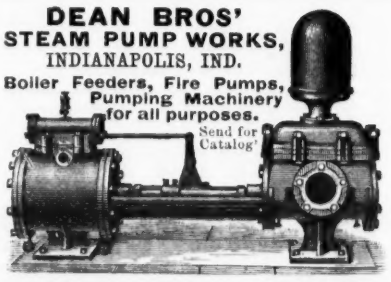

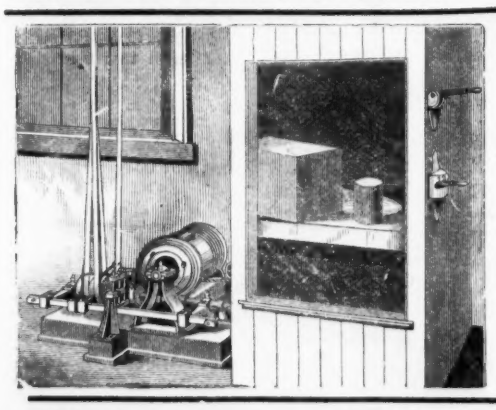

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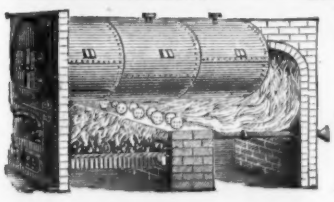

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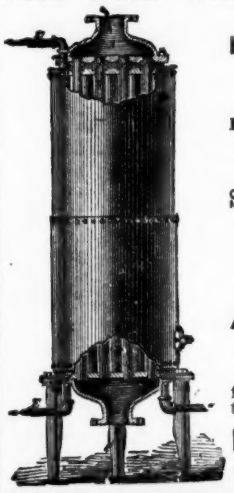

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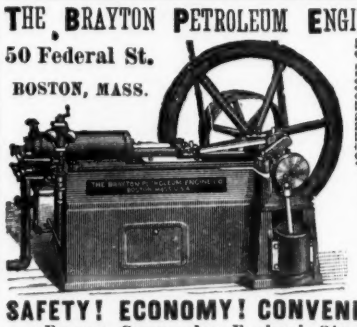

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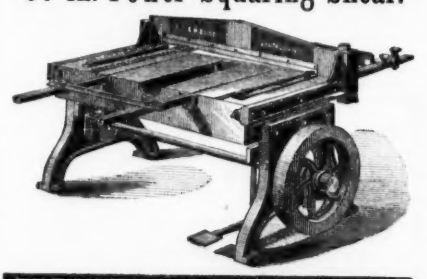

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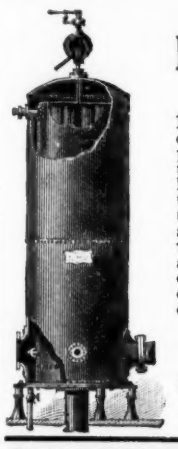

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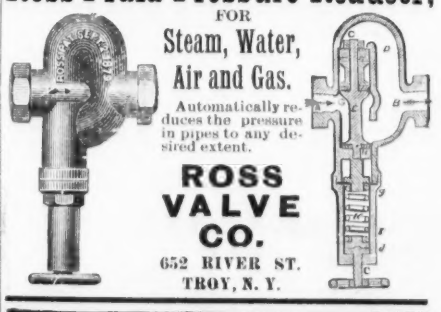

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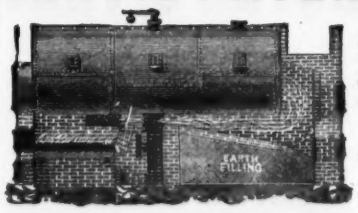

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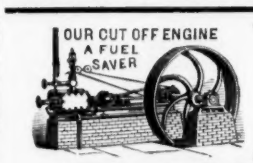

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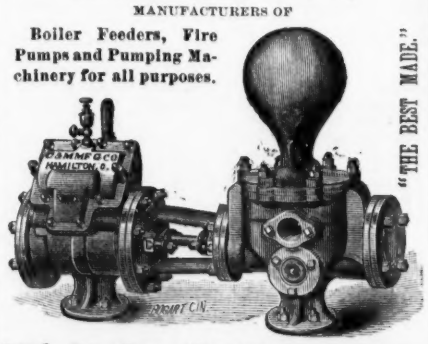

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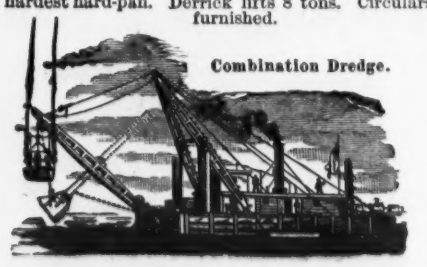

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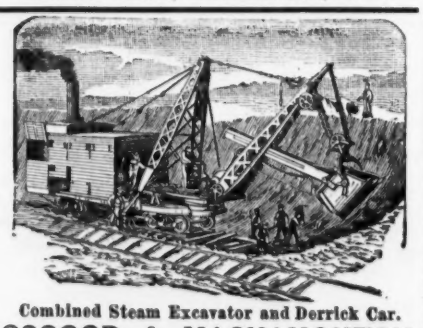

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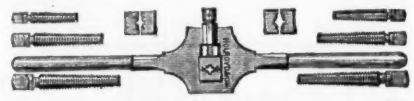

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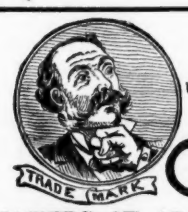

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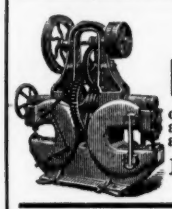

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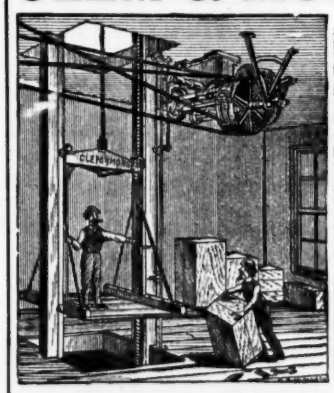

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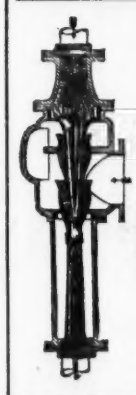

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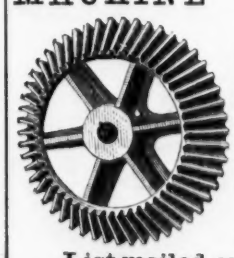

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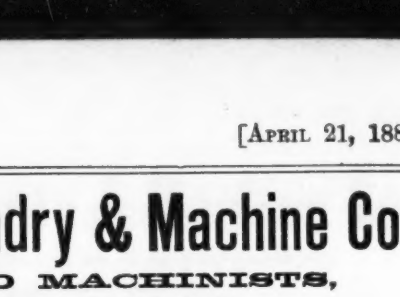

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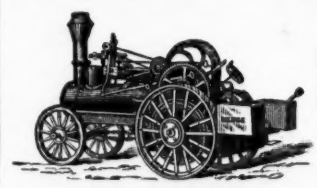

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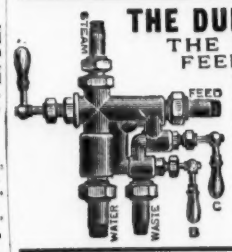

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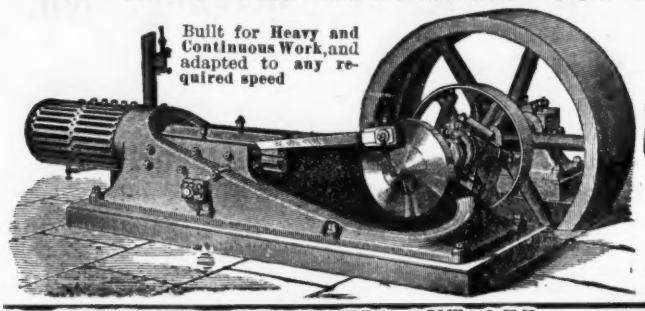

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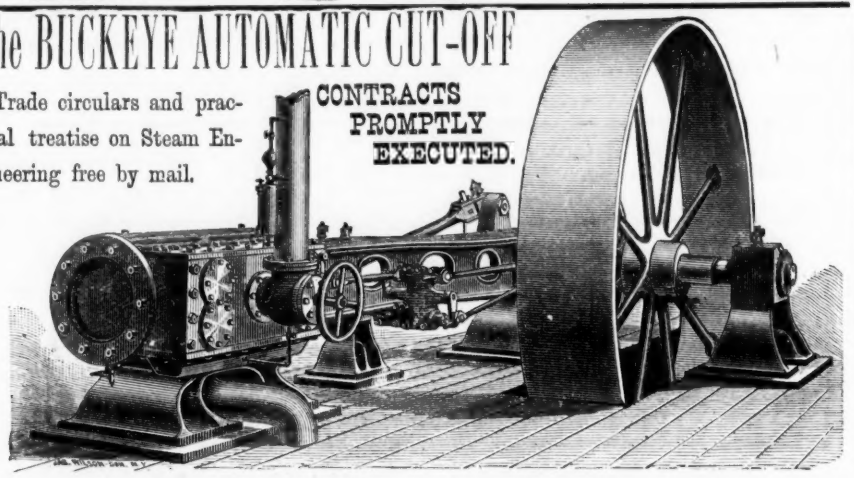

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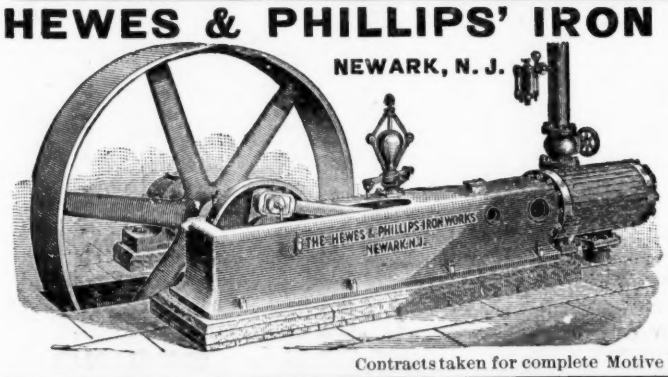

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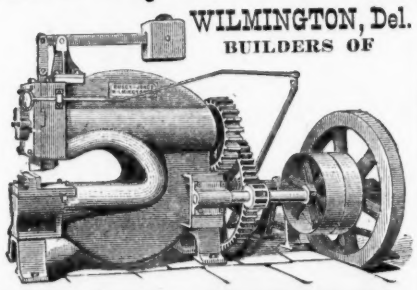

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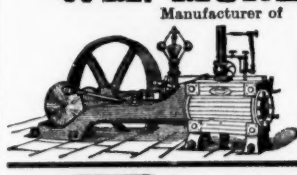

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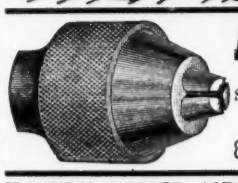

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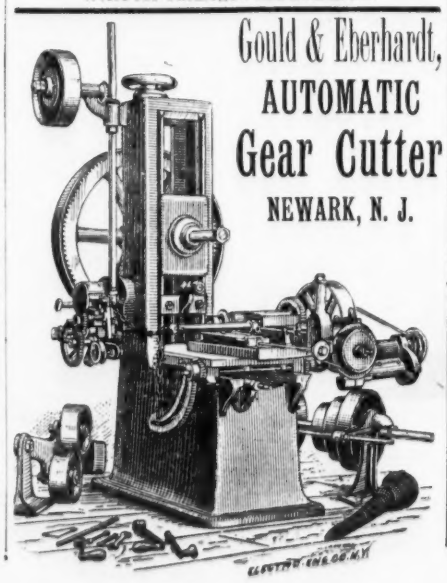

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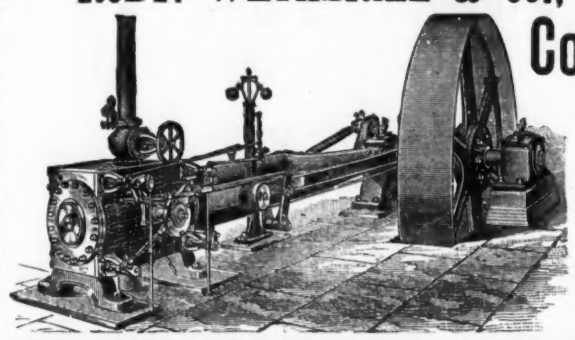

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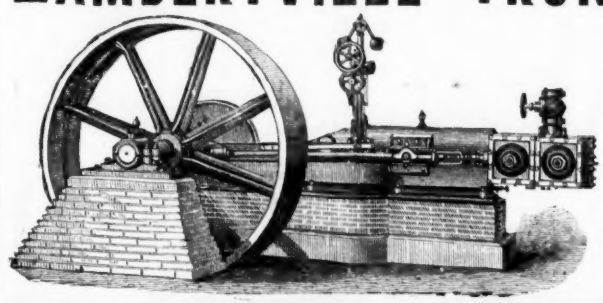

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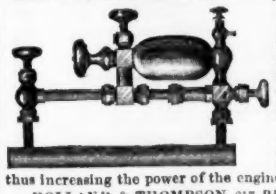

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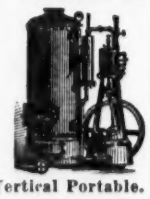

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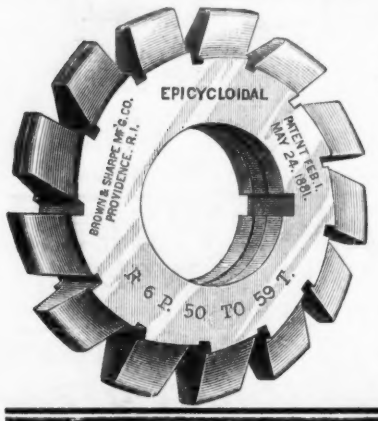

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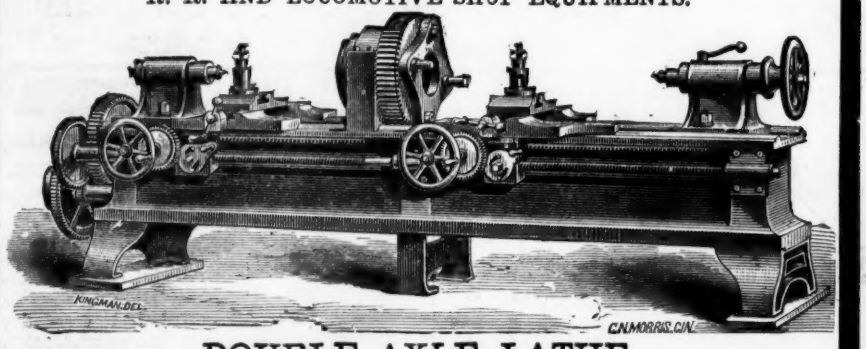

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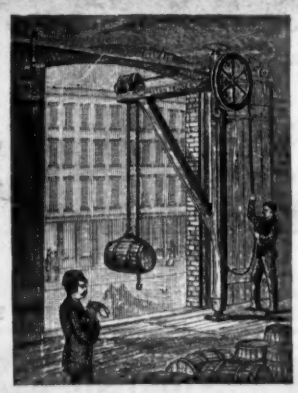

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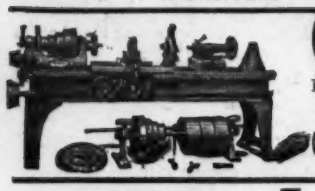

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